7. Zadanie z LCRP – teoretická časť

J. Oravec

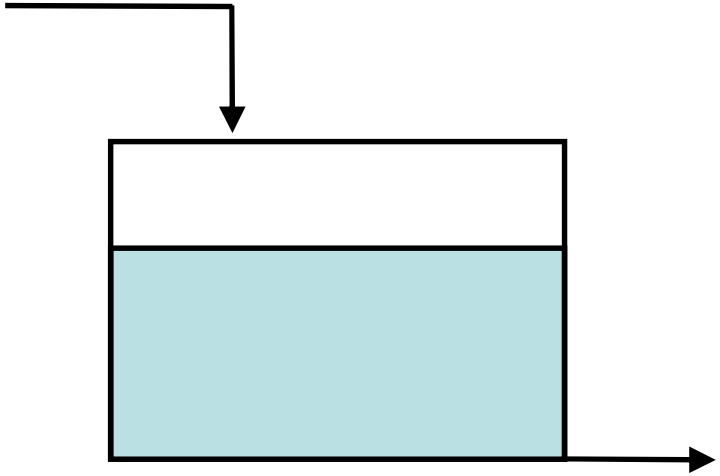
7. Zadanie z LCRP – teoretická časť

- **URO**
- **prenos URO**
- **CHR URO**
- **zákon riadenia**
- **Routhovo-Schurovo kritérium stability**

7. Zadanie z LCRP – teoretická časť

- **URO**
- **prenos URO**
- **CHR URO**
- **zákon riadenia**
- **Routhovo-Schurovo kritérium stability**

URO



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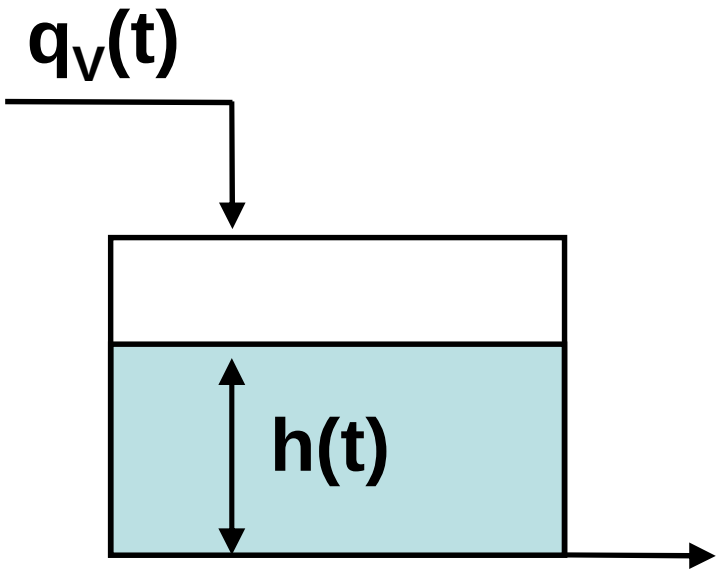

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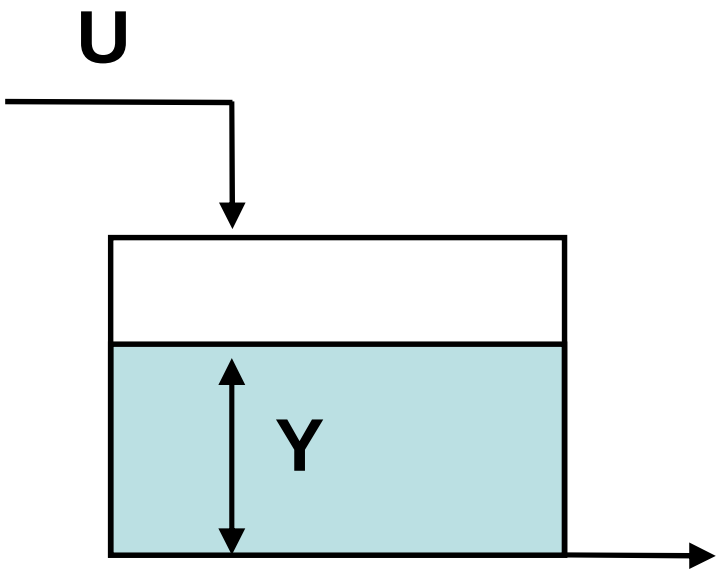

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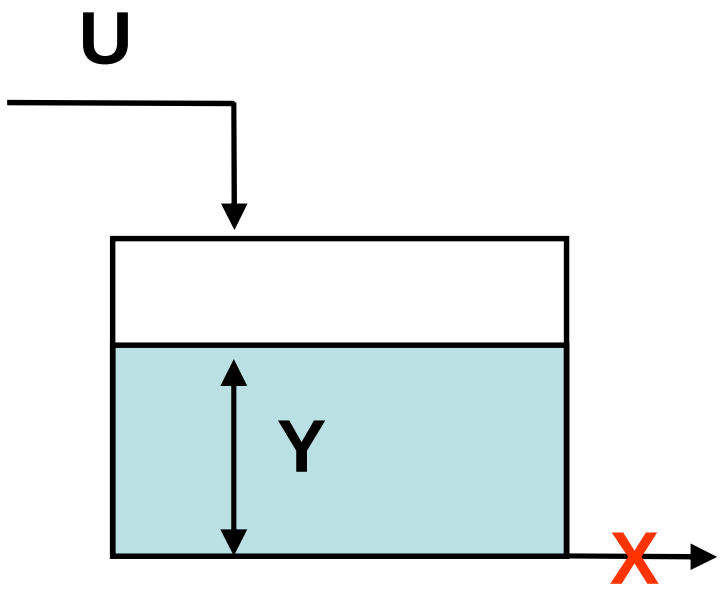

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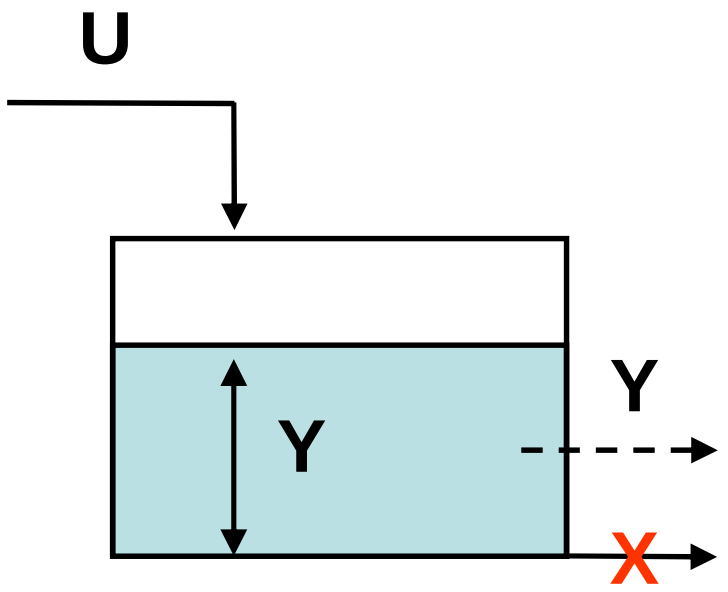

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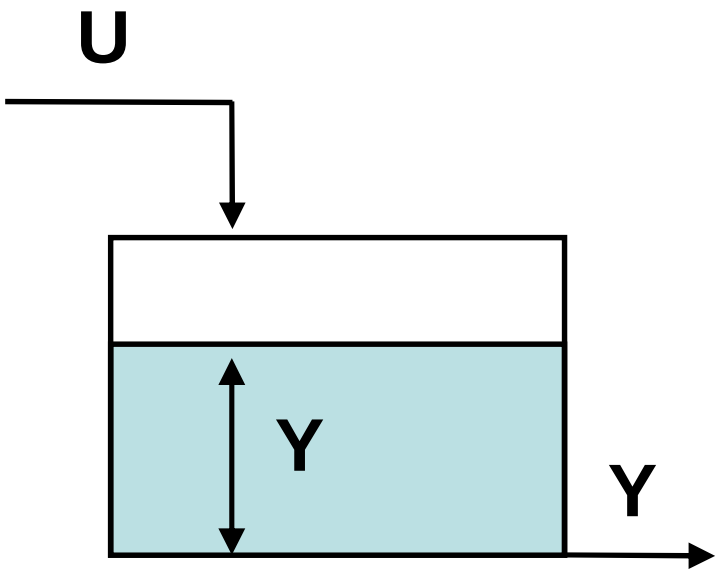

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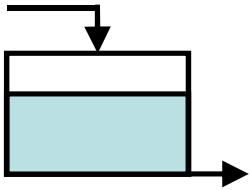

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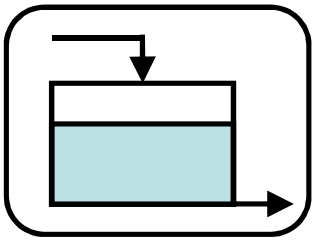

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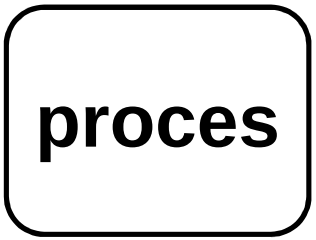

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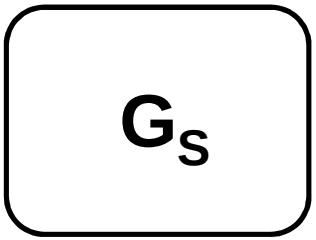

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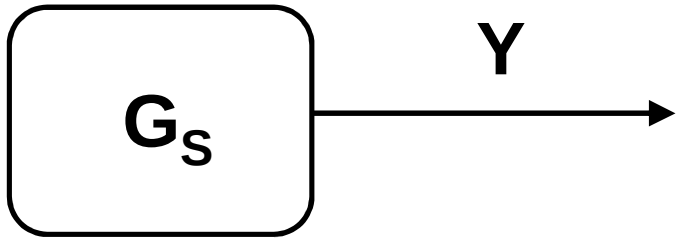

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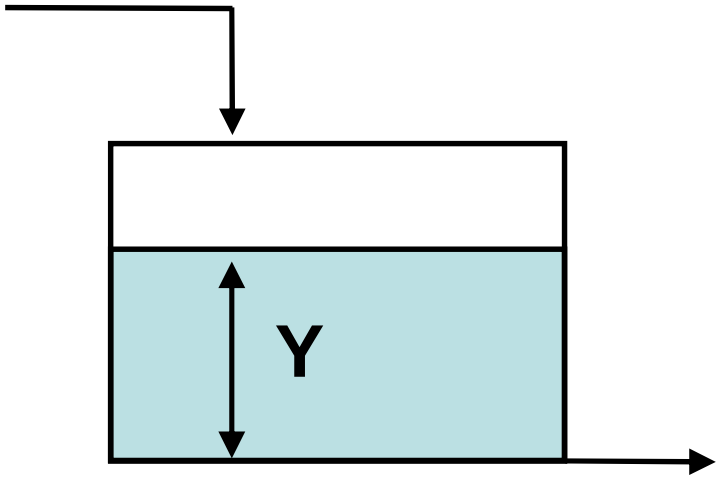

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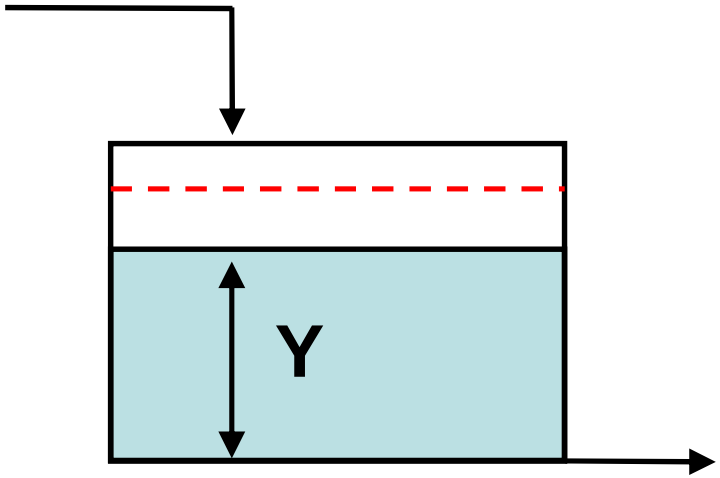

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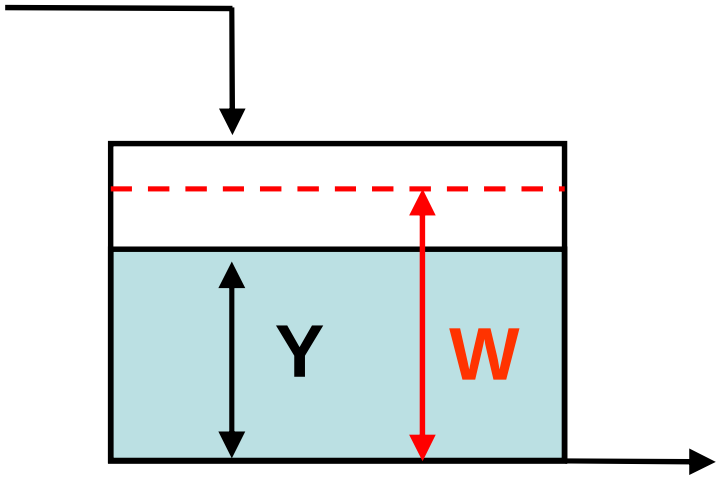

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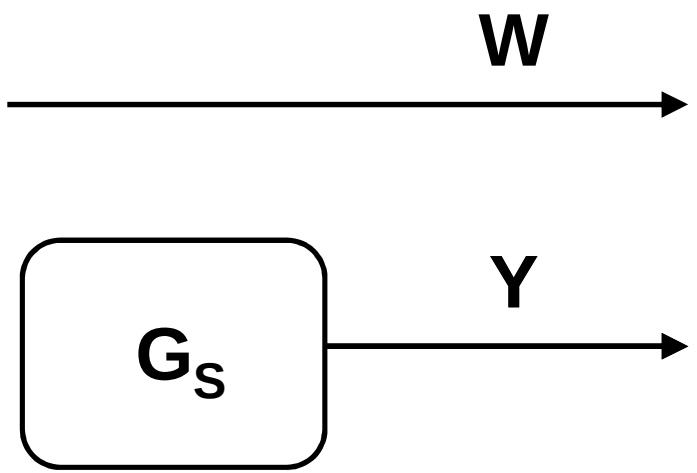

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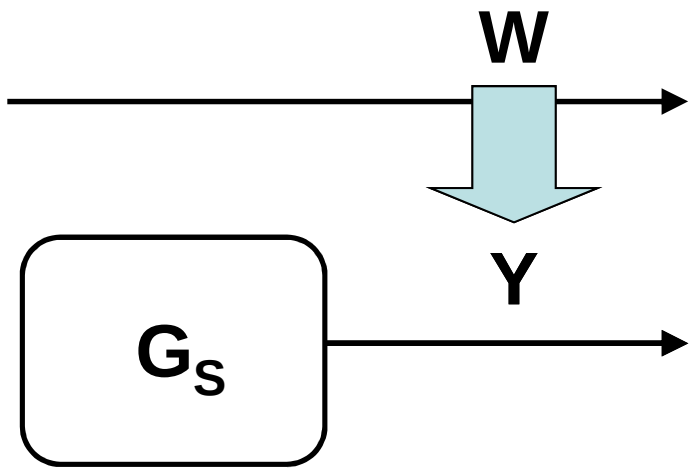

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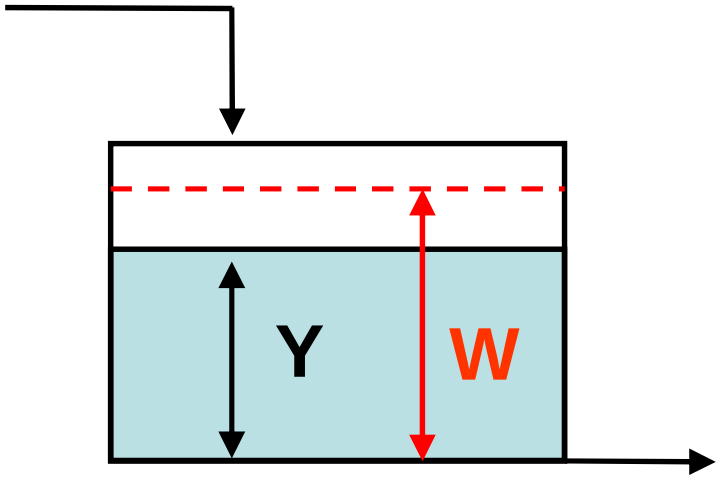

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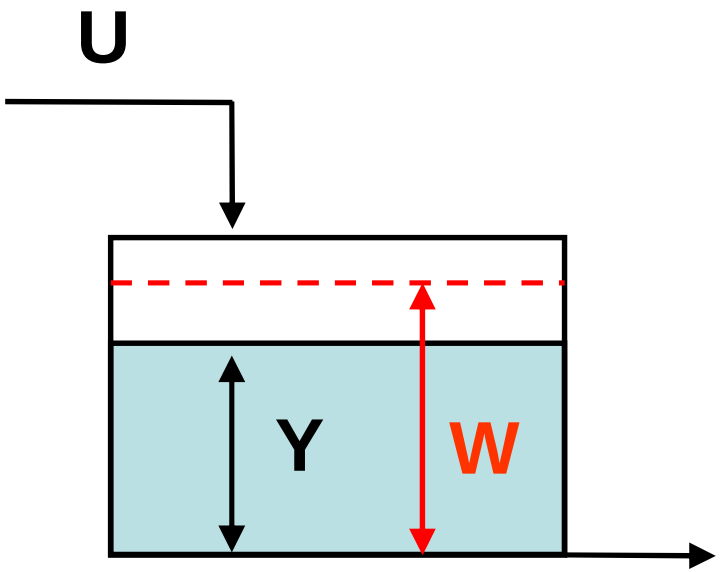

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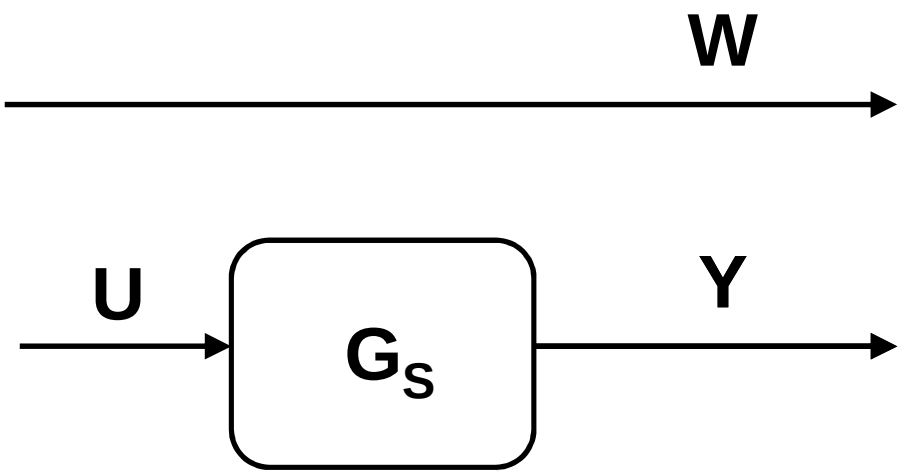

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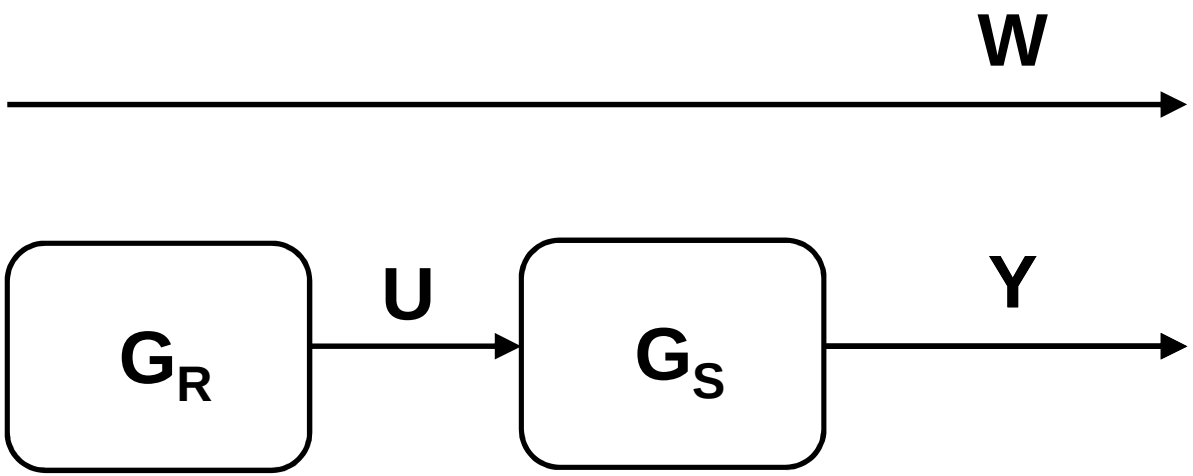

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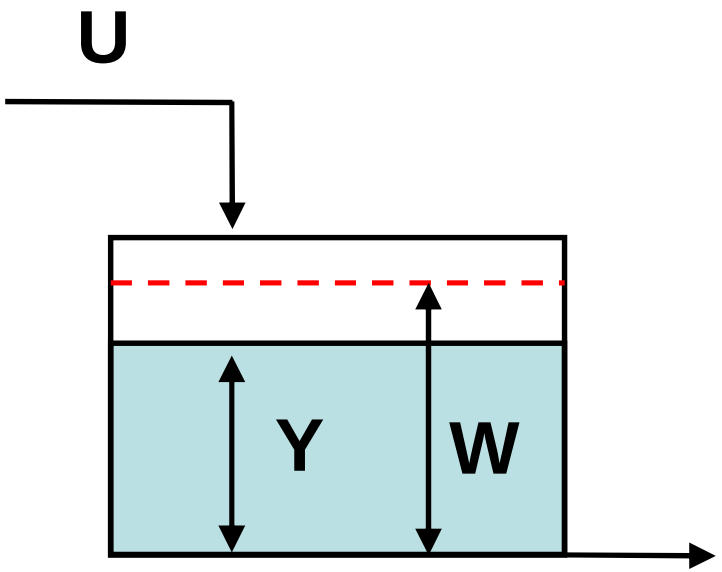

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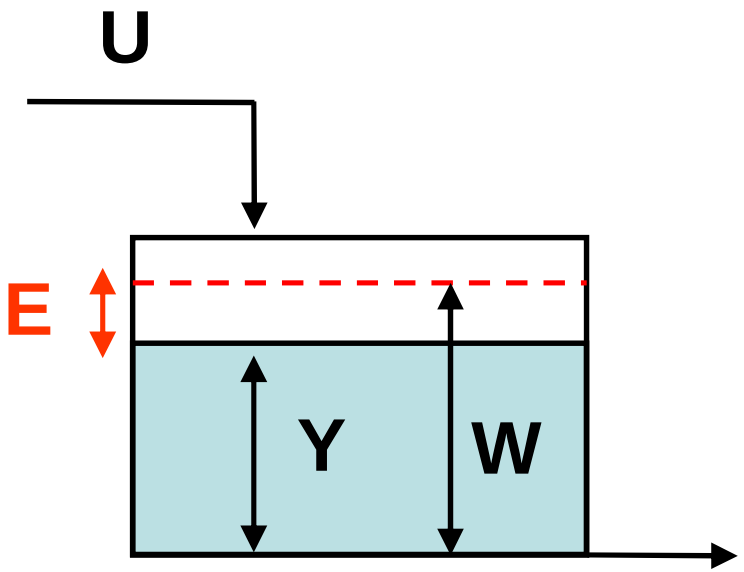

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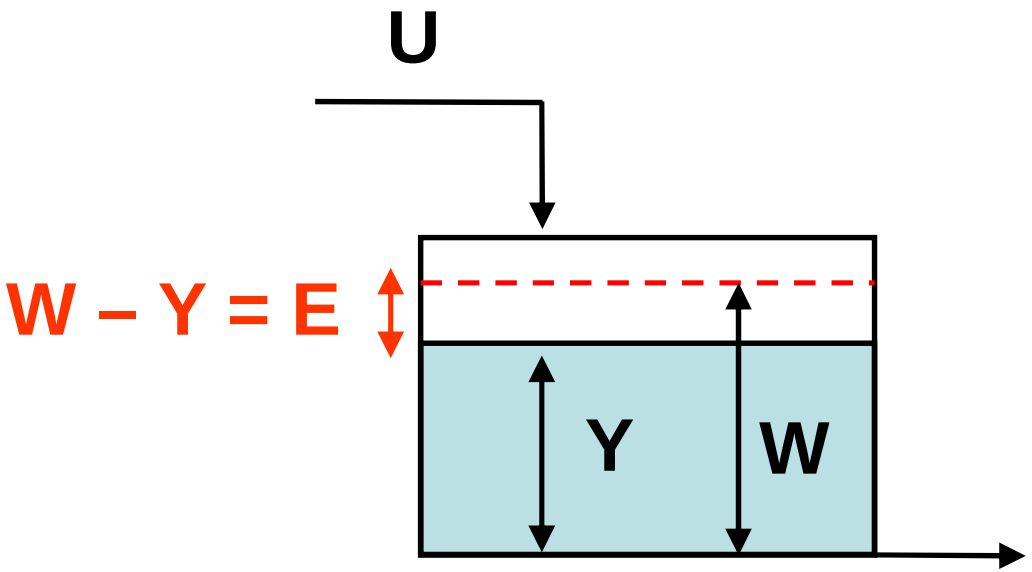

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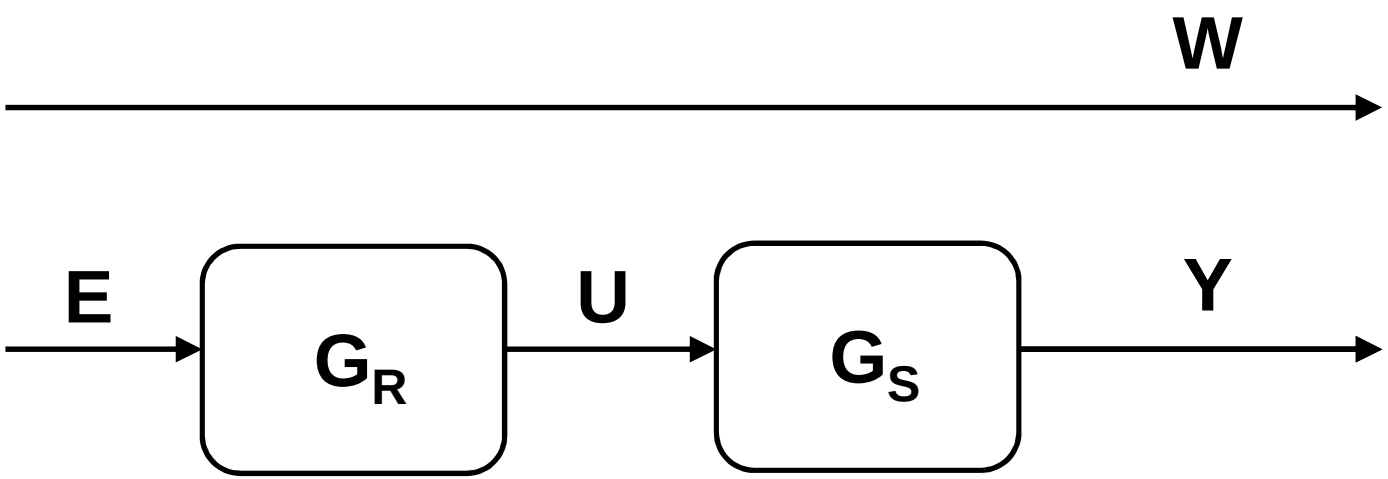

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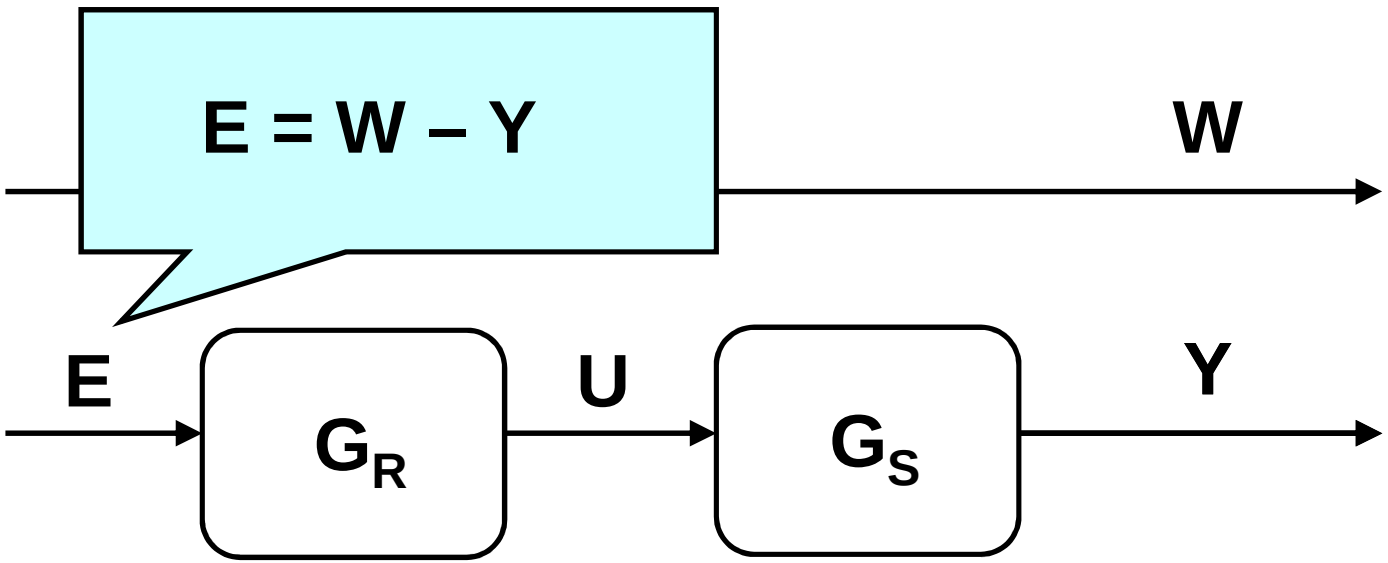

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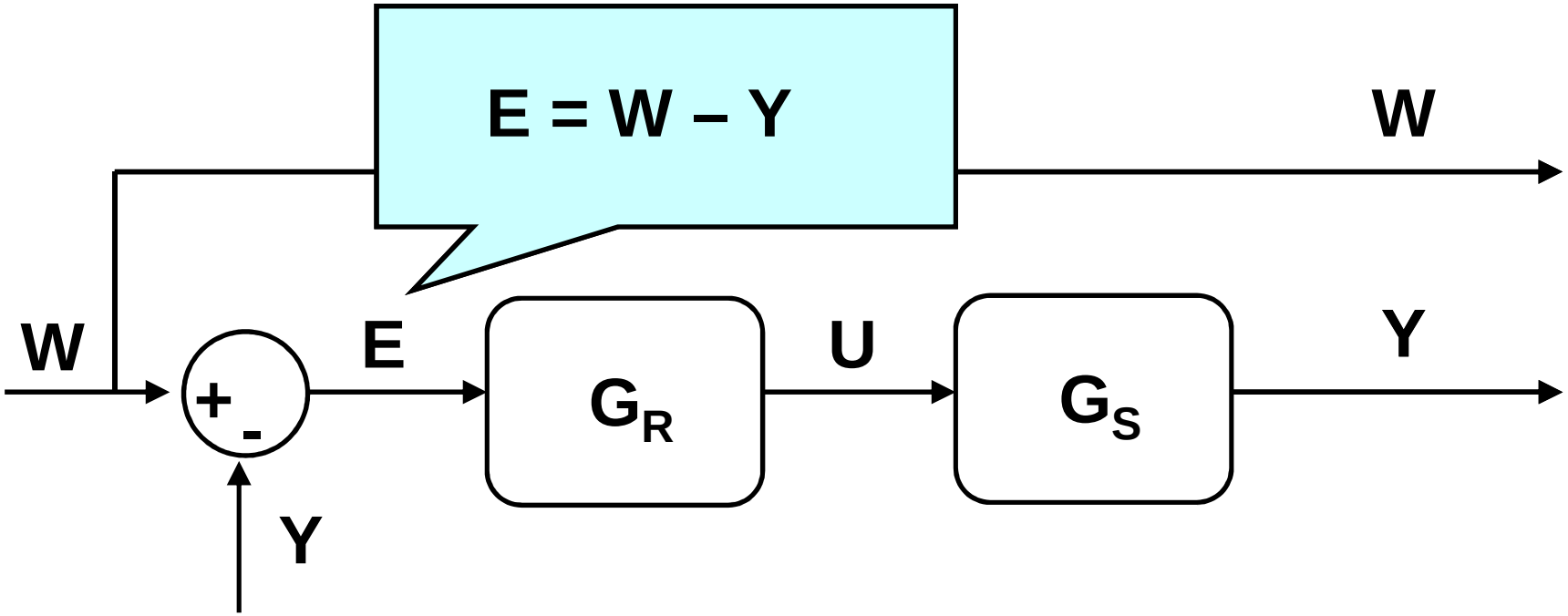

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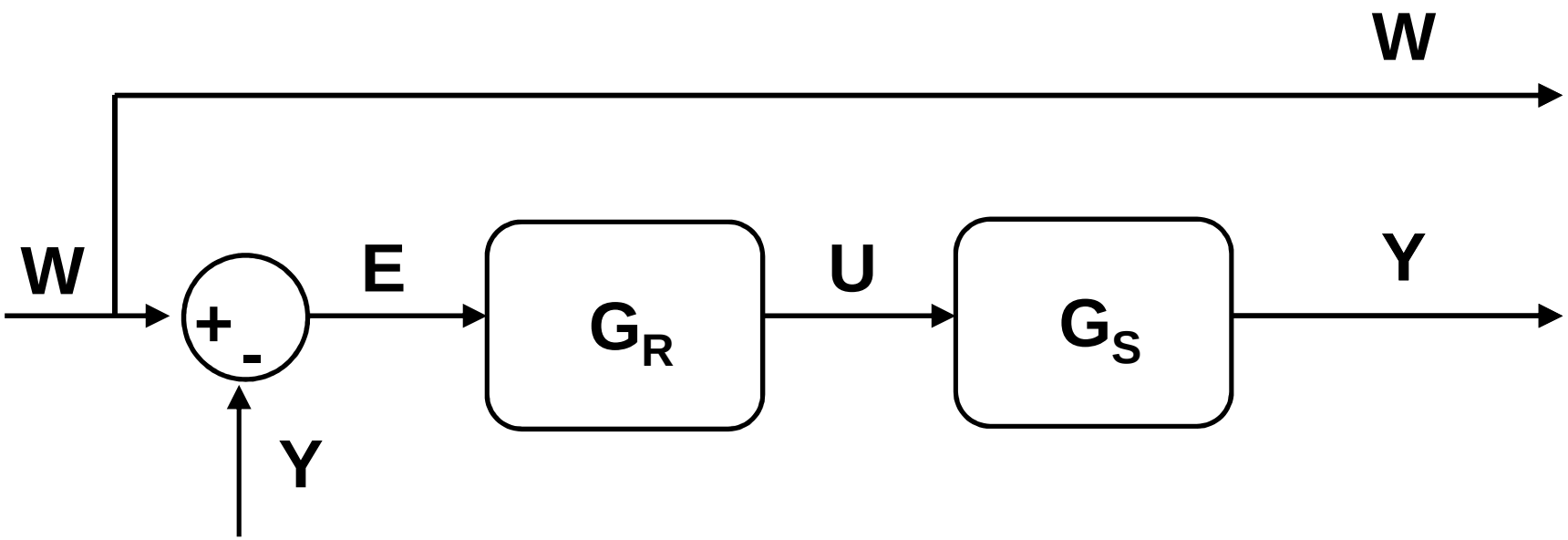

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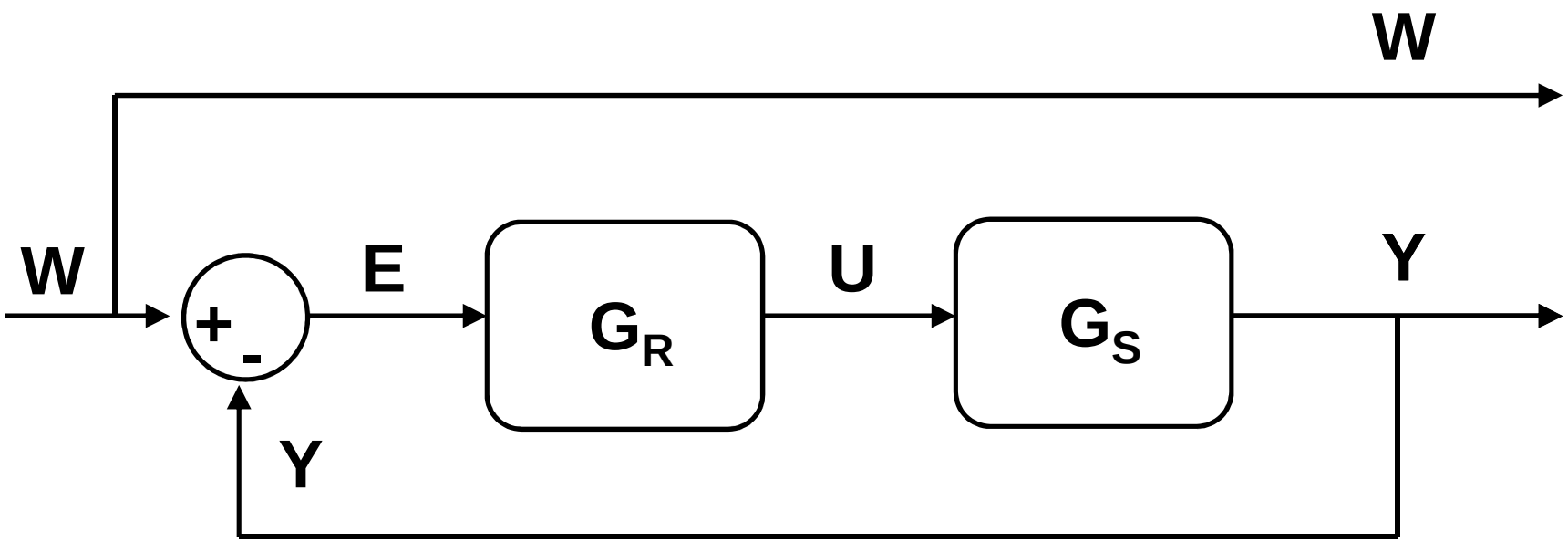

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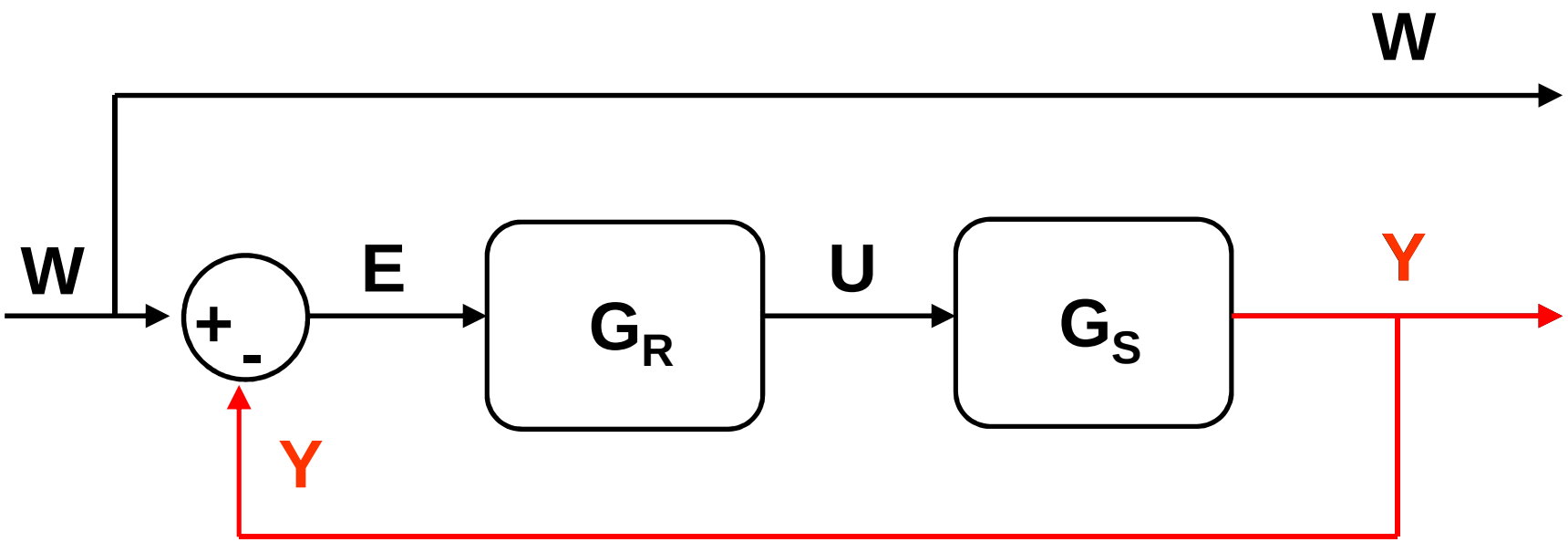

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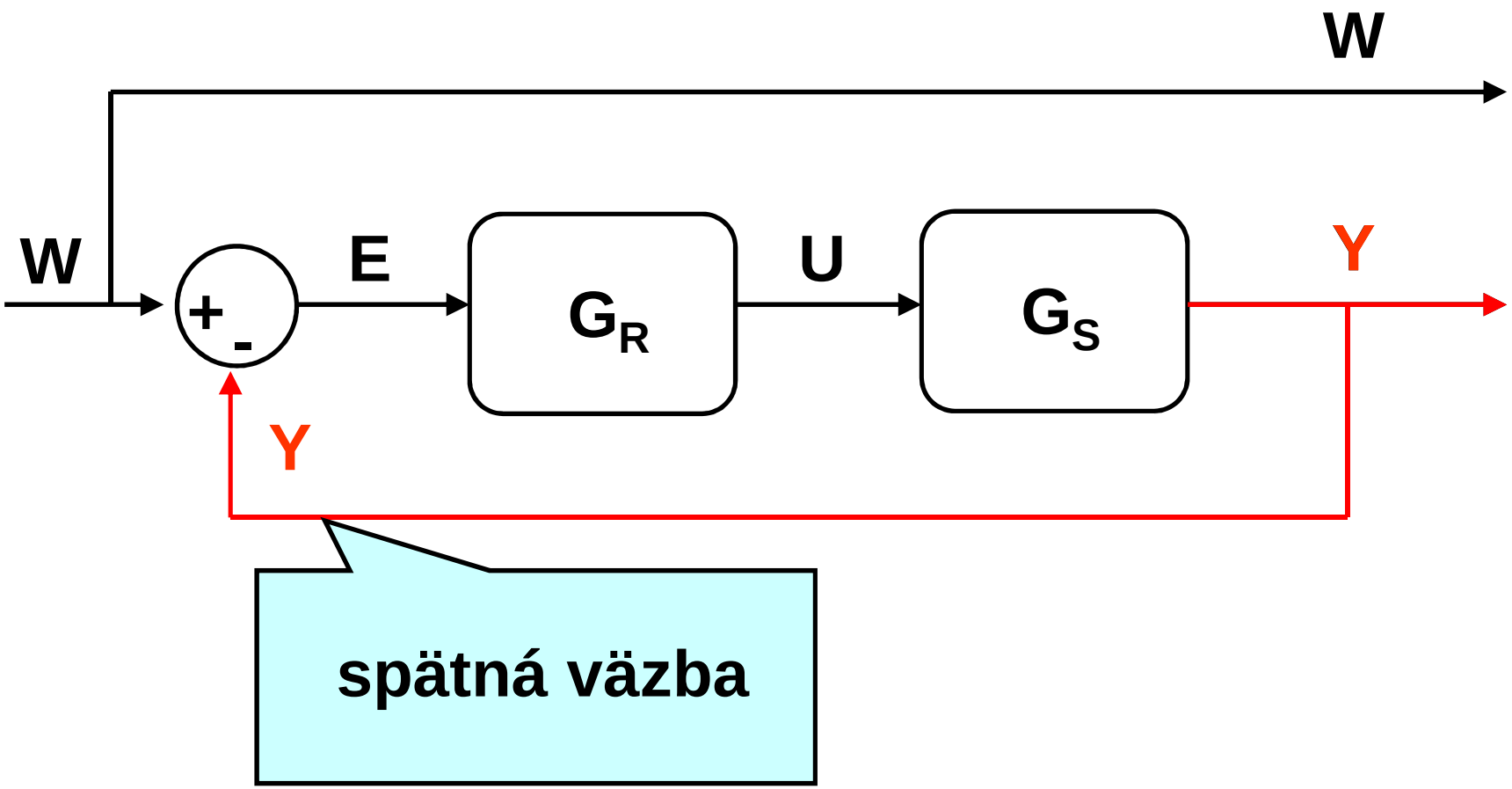

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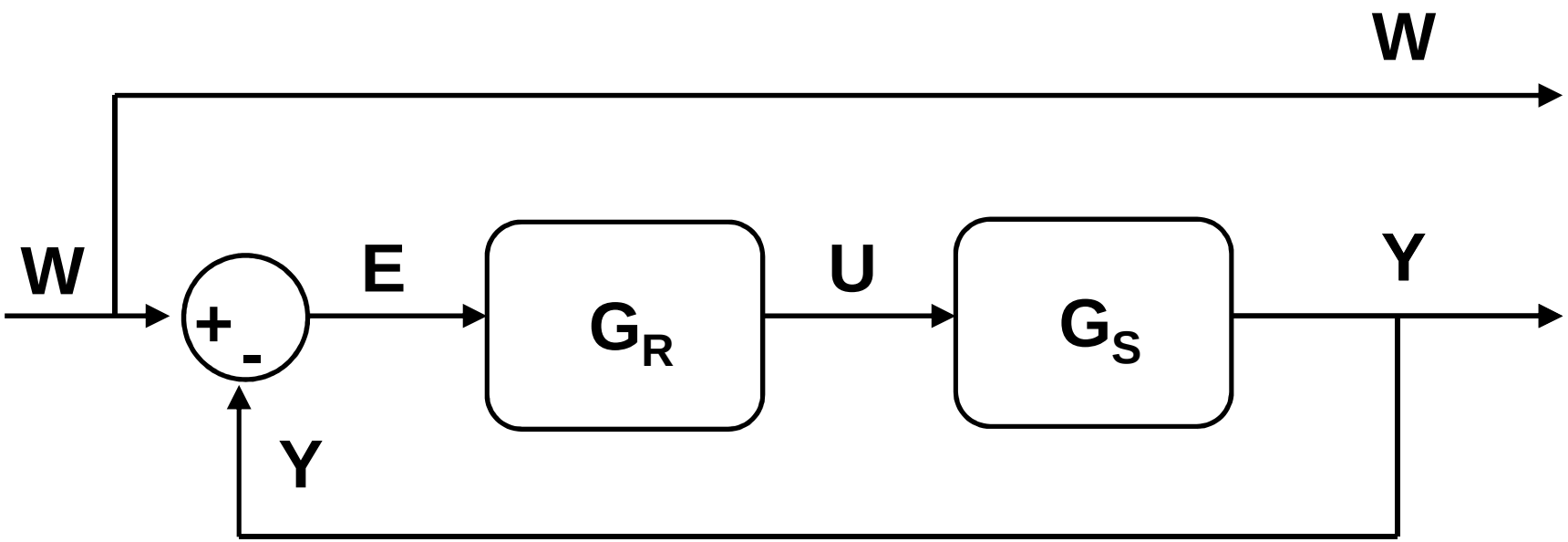

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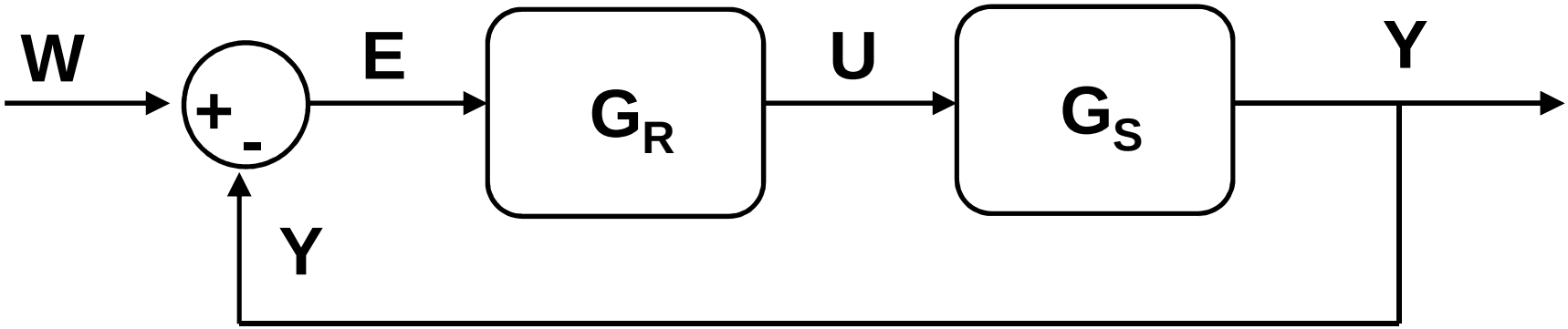

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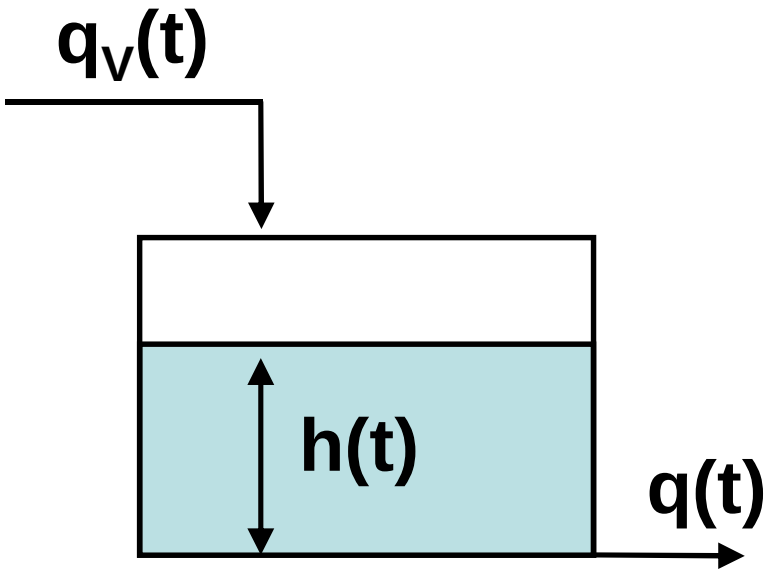

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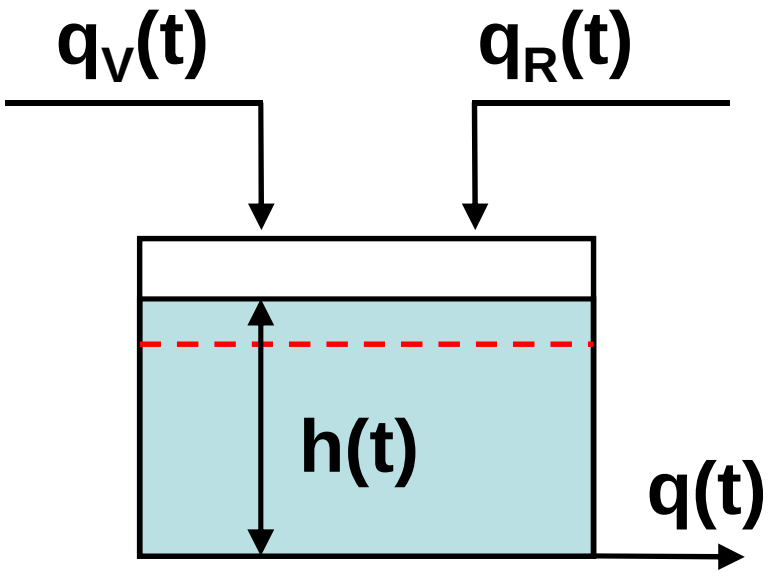

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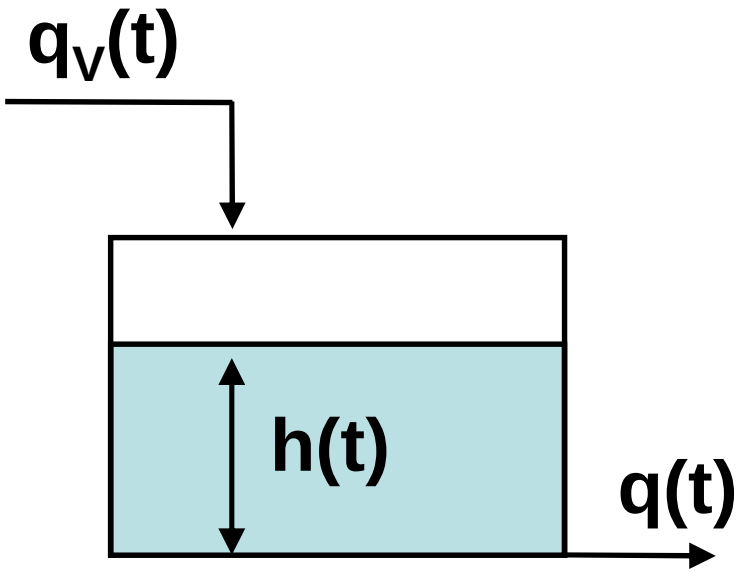

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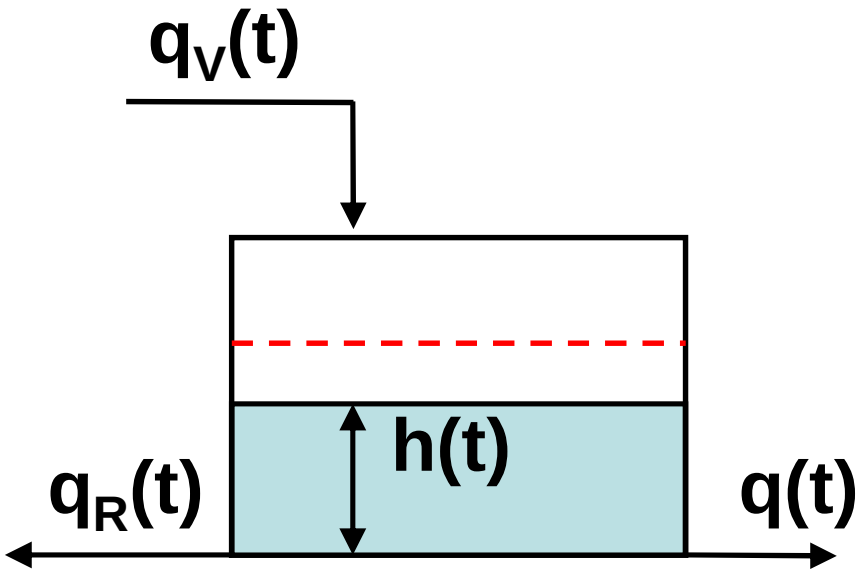

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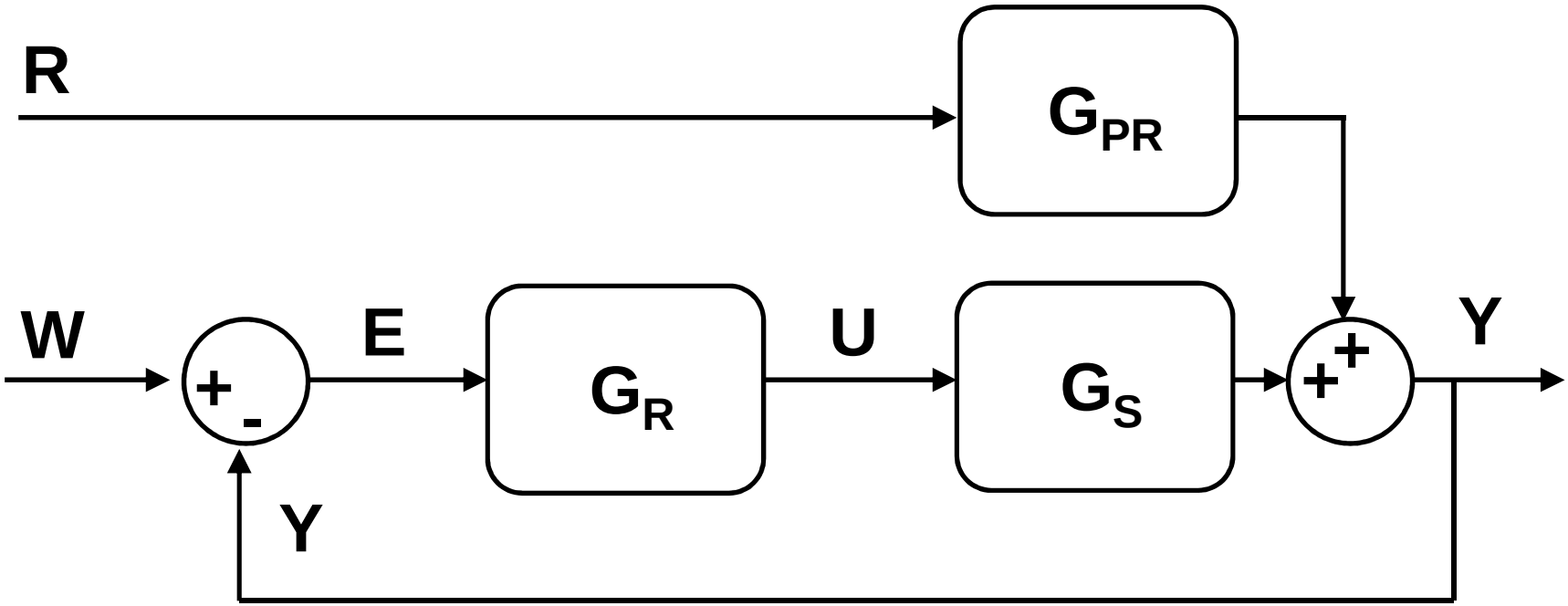

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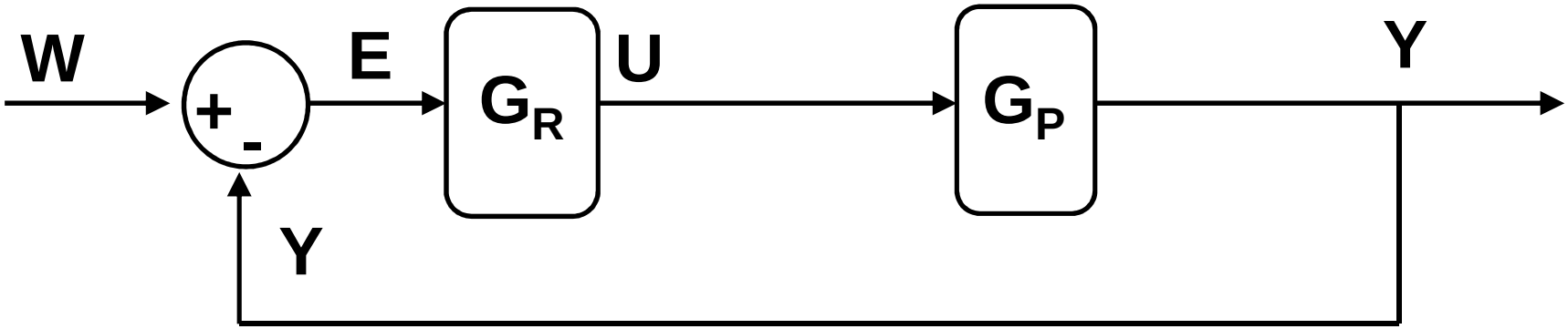

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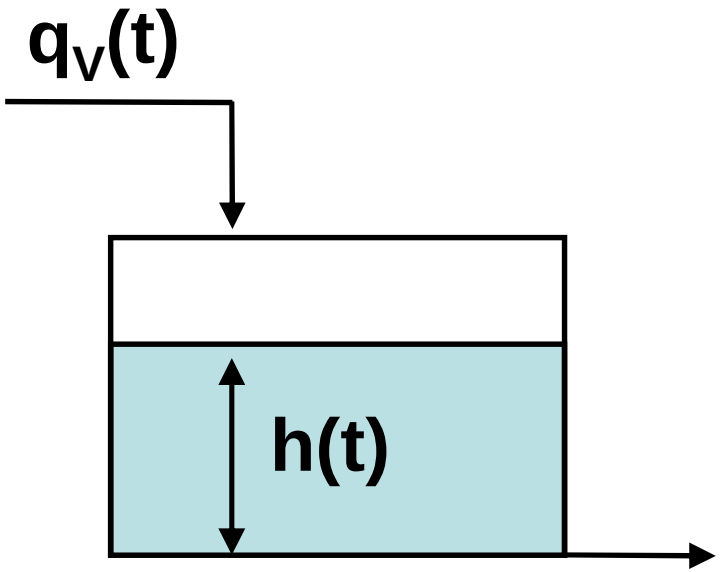

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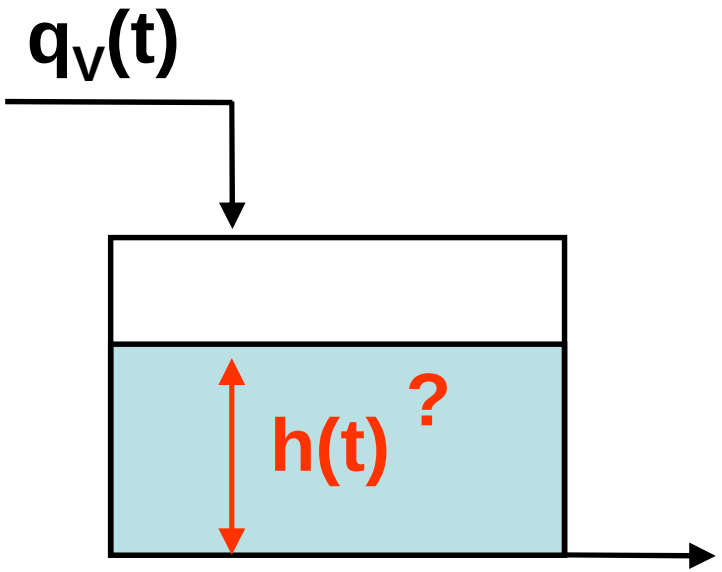

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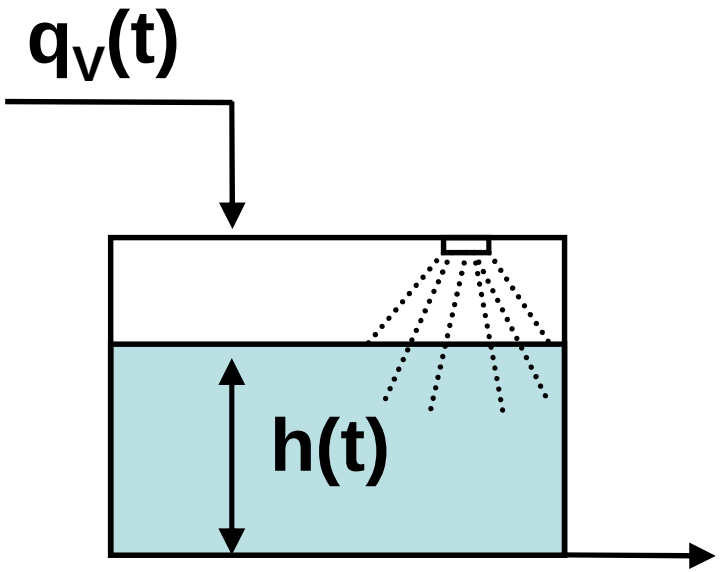

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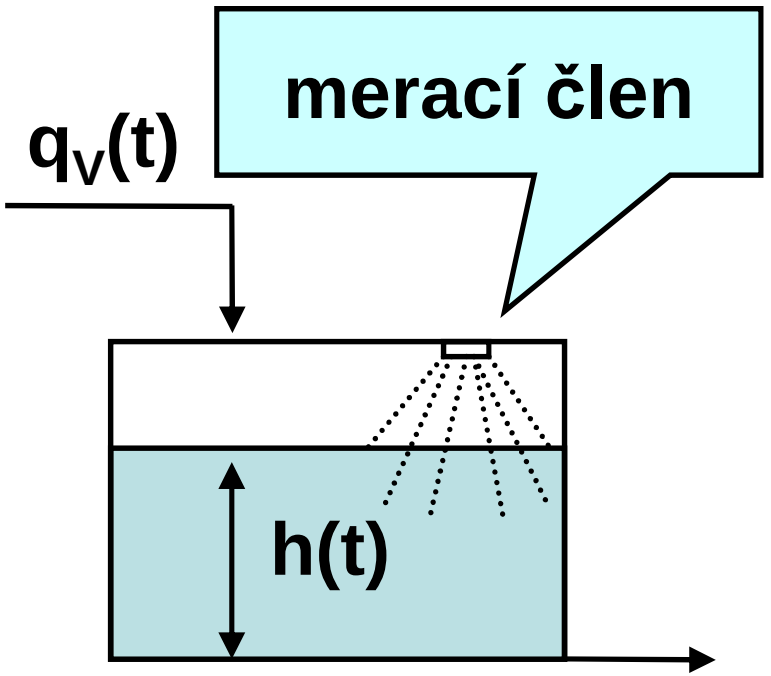

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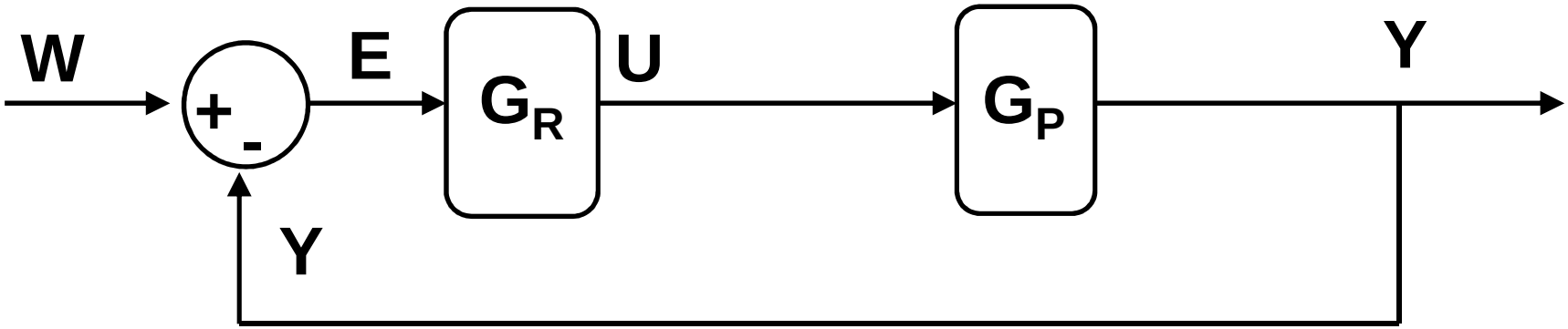

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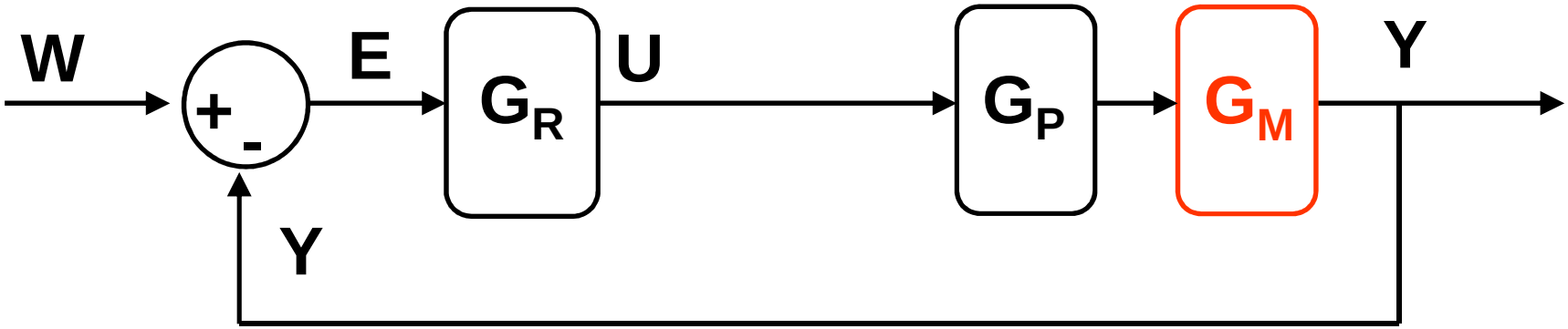

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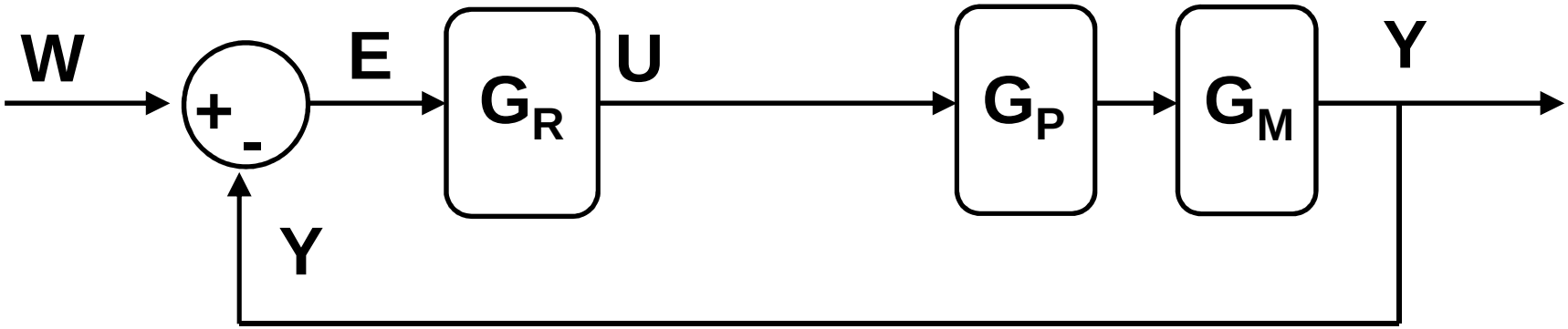

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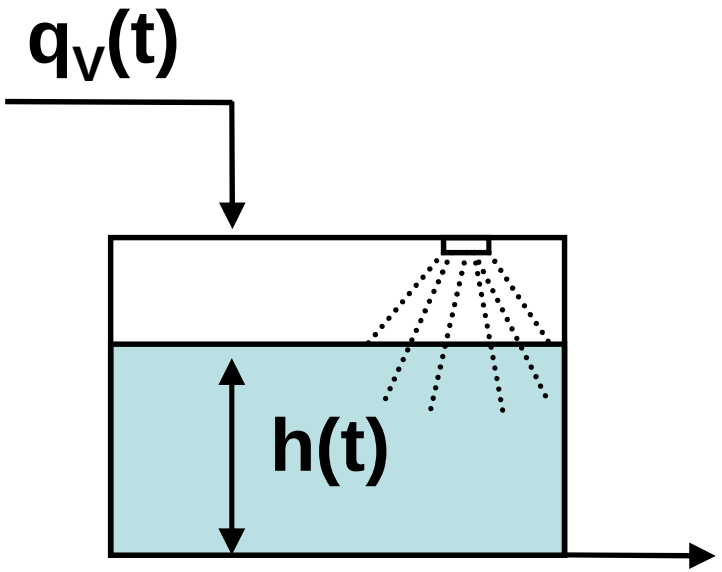

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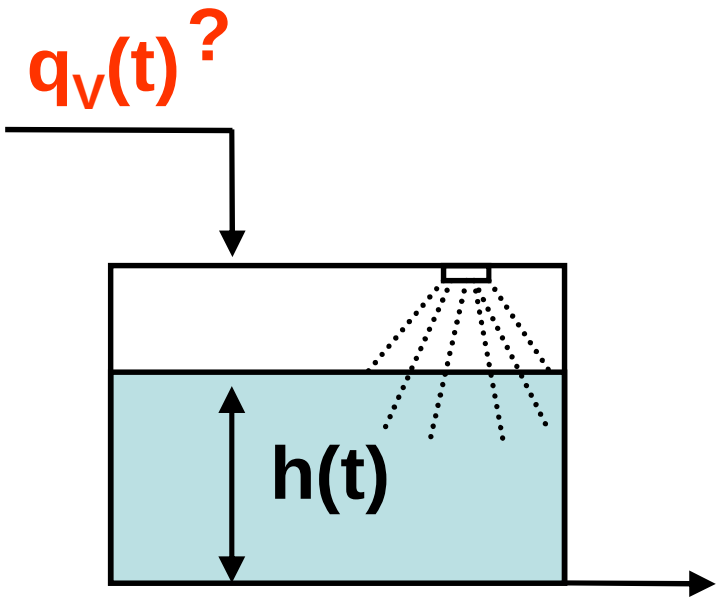

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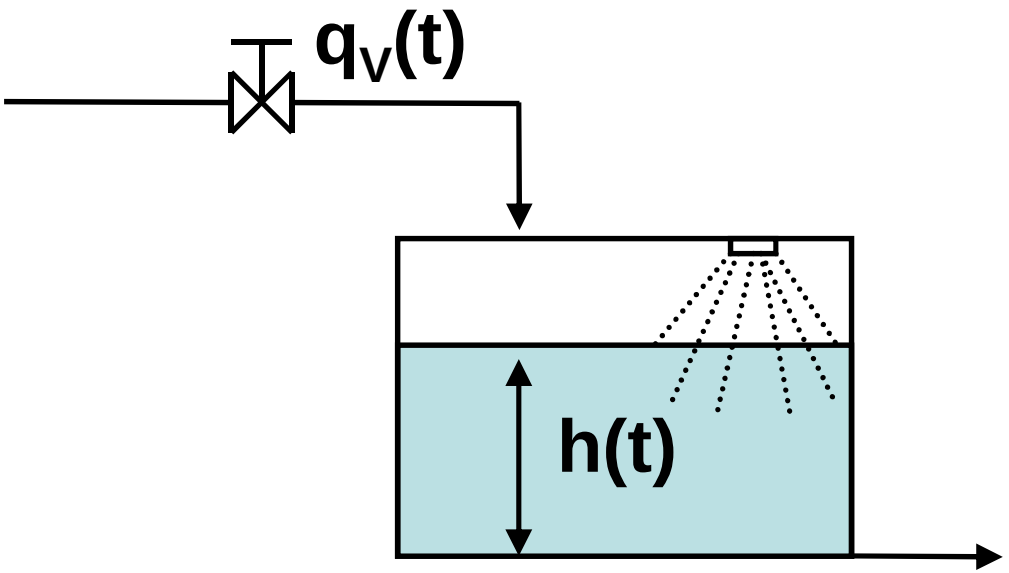

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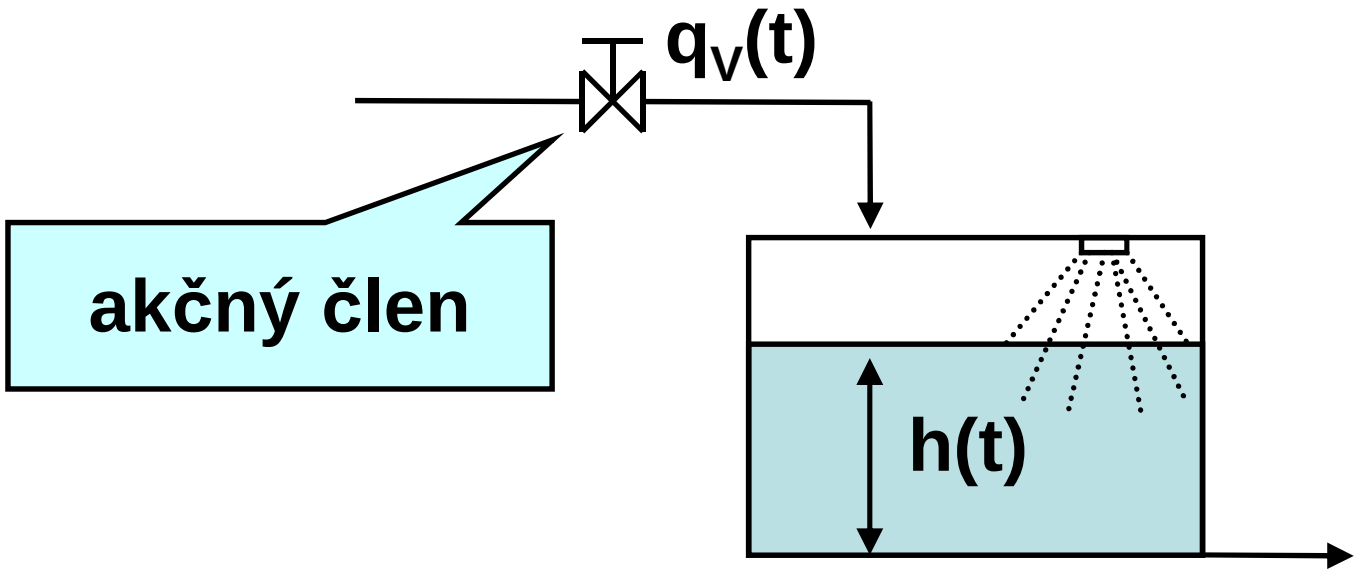

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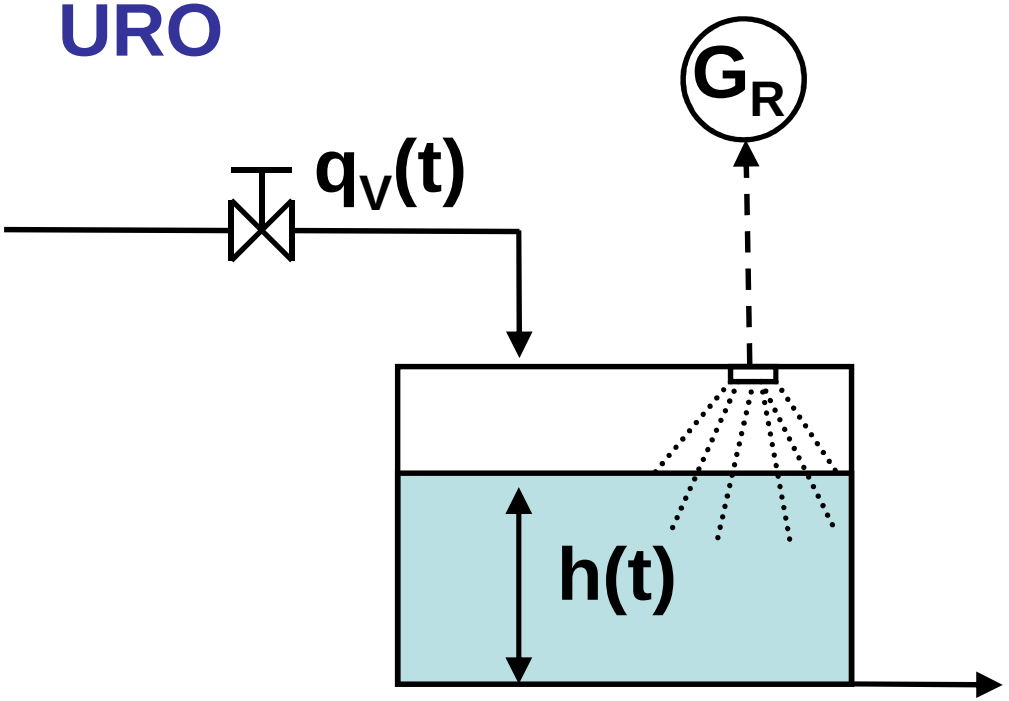

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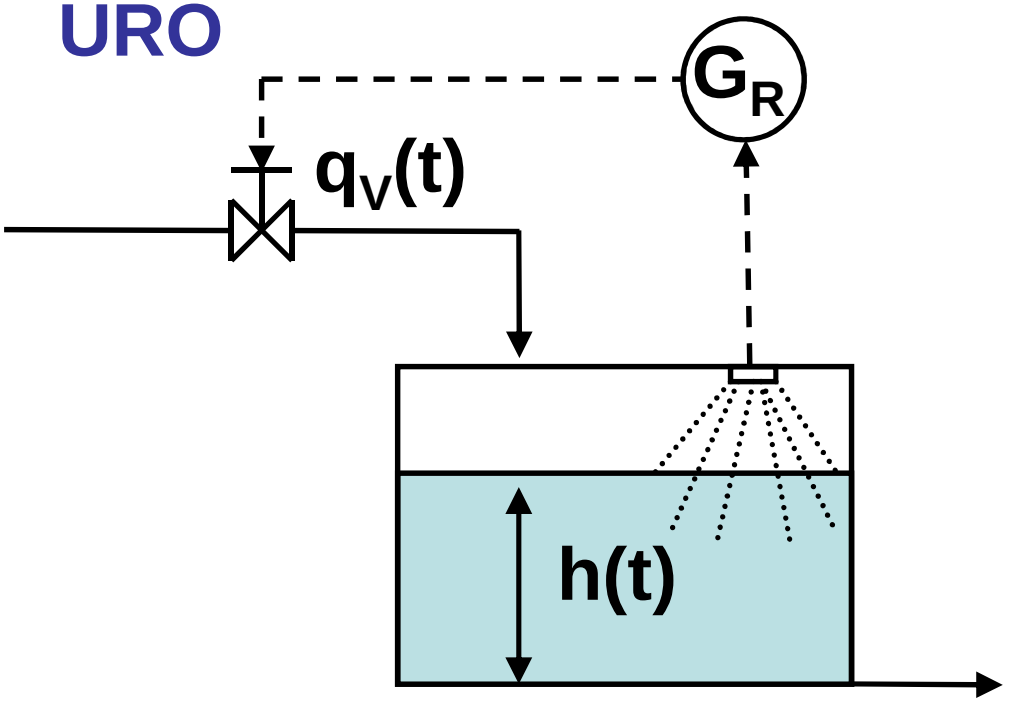
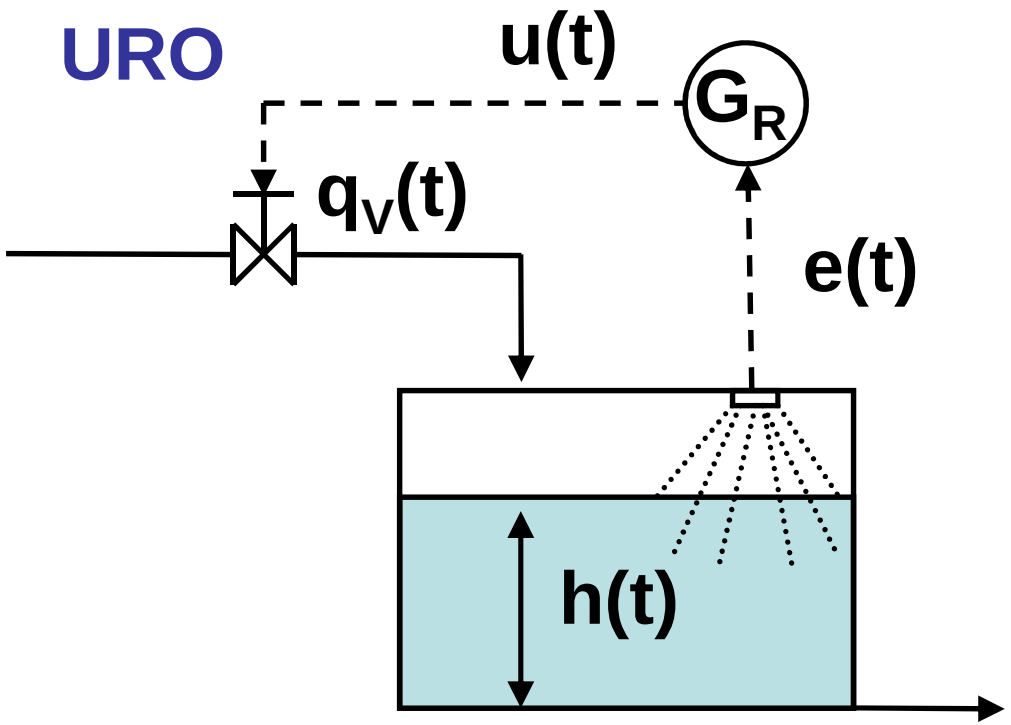
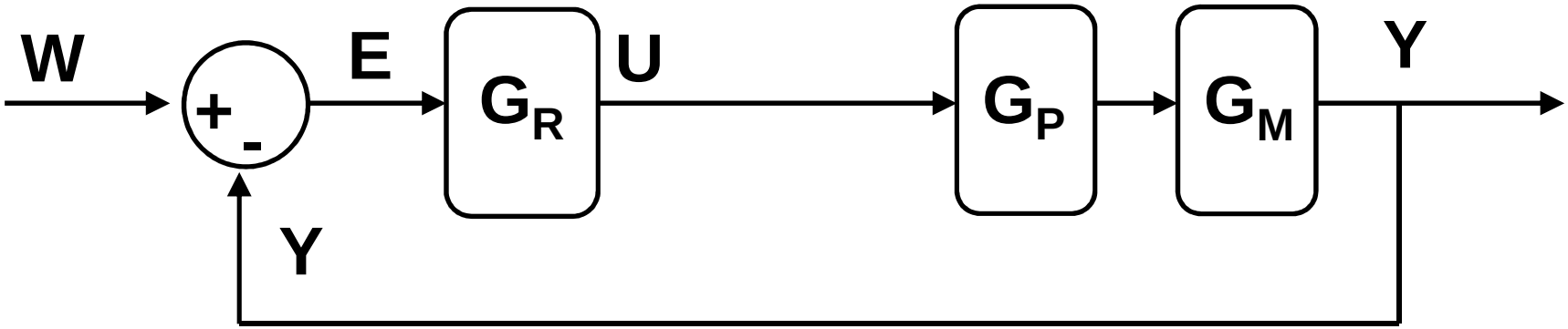



URO
u(t)
G_R
$q_V(t)$
e(t)
h(t)

URO



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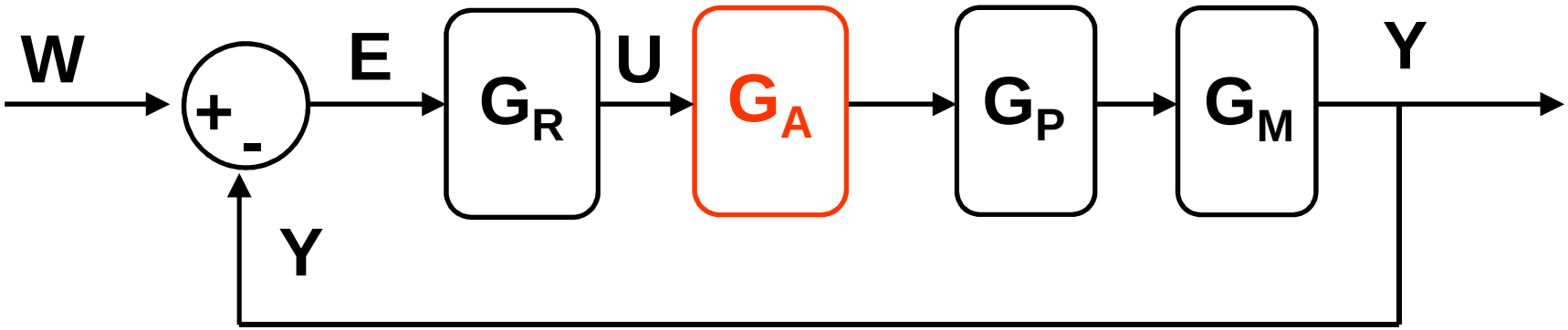

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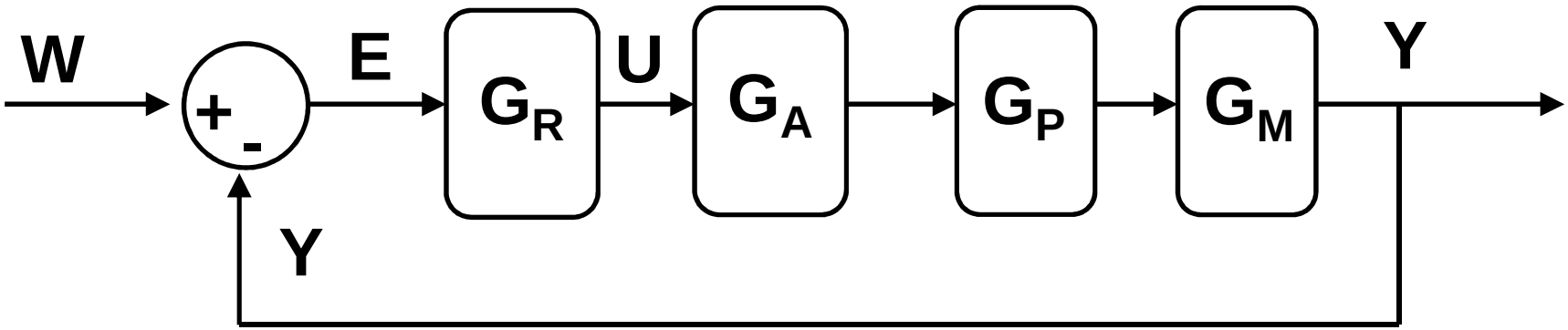

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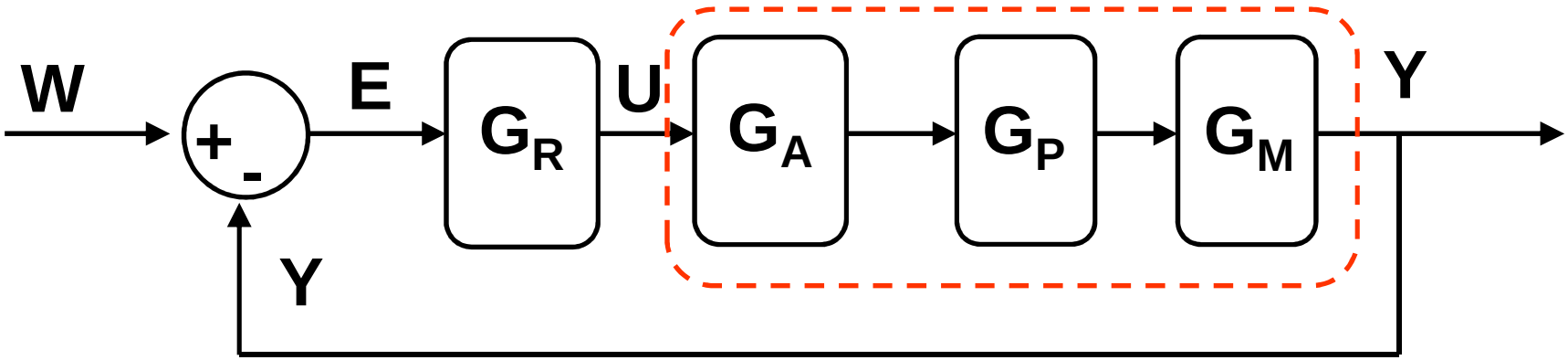

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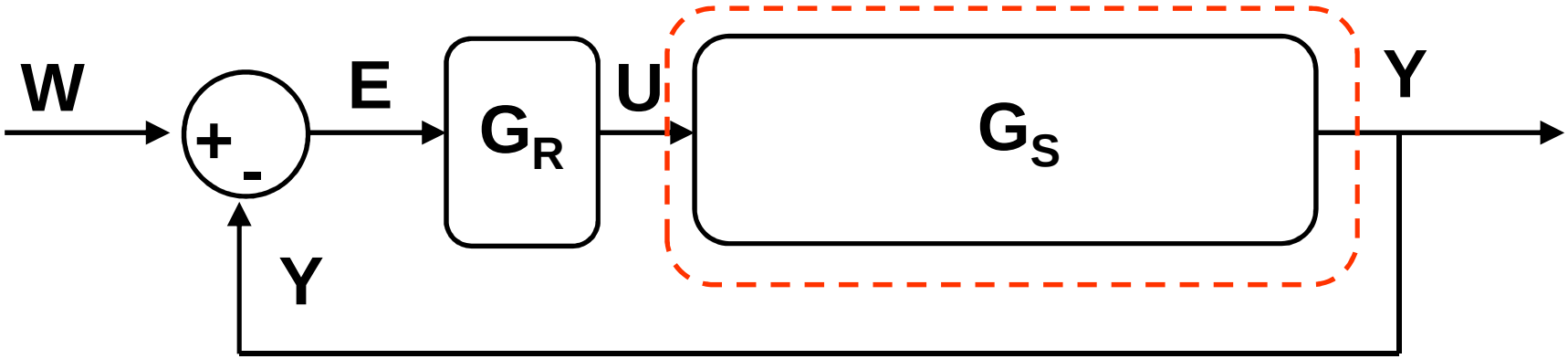

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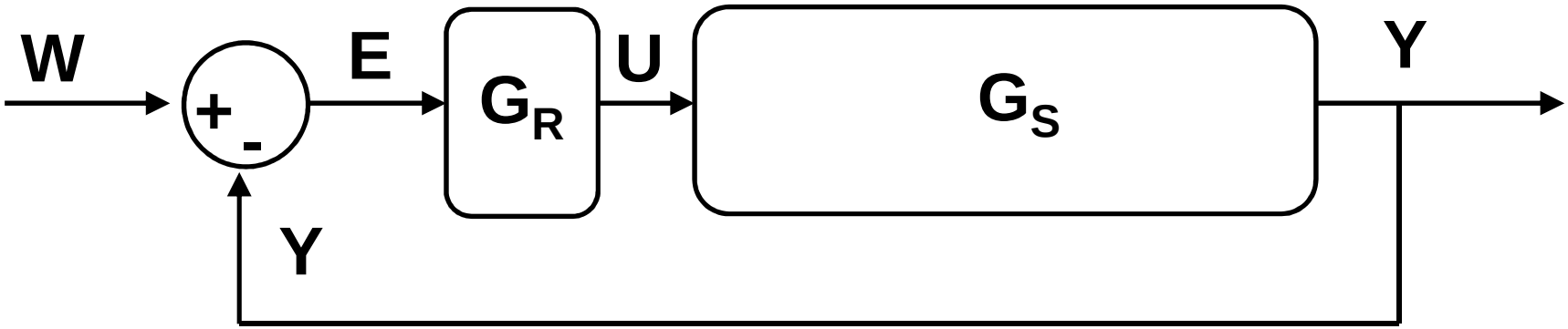

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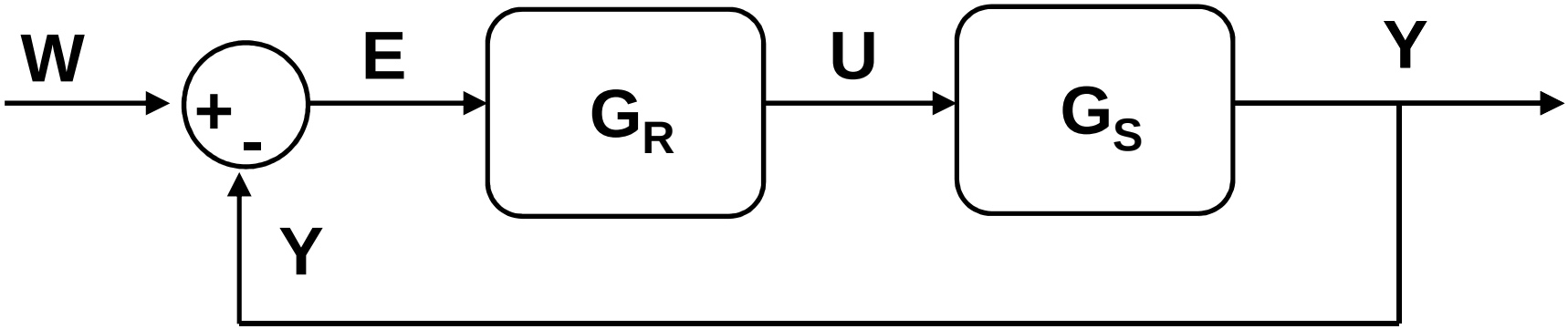
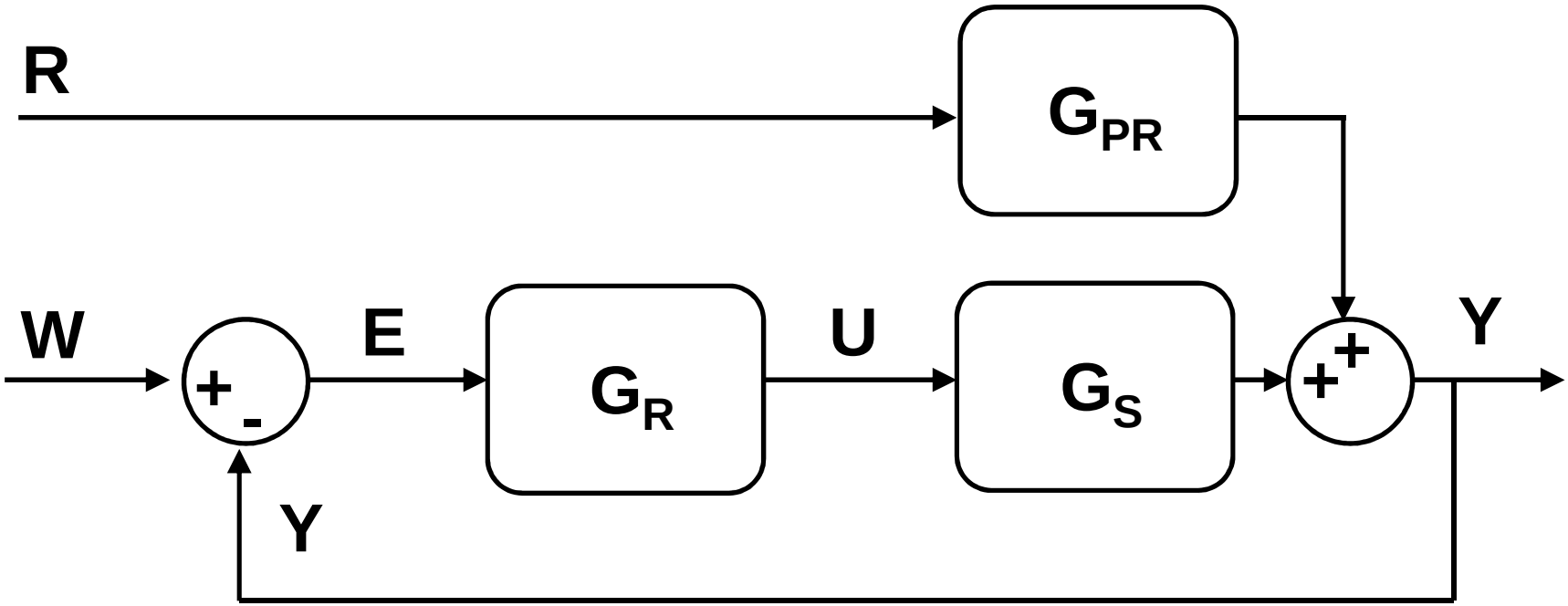


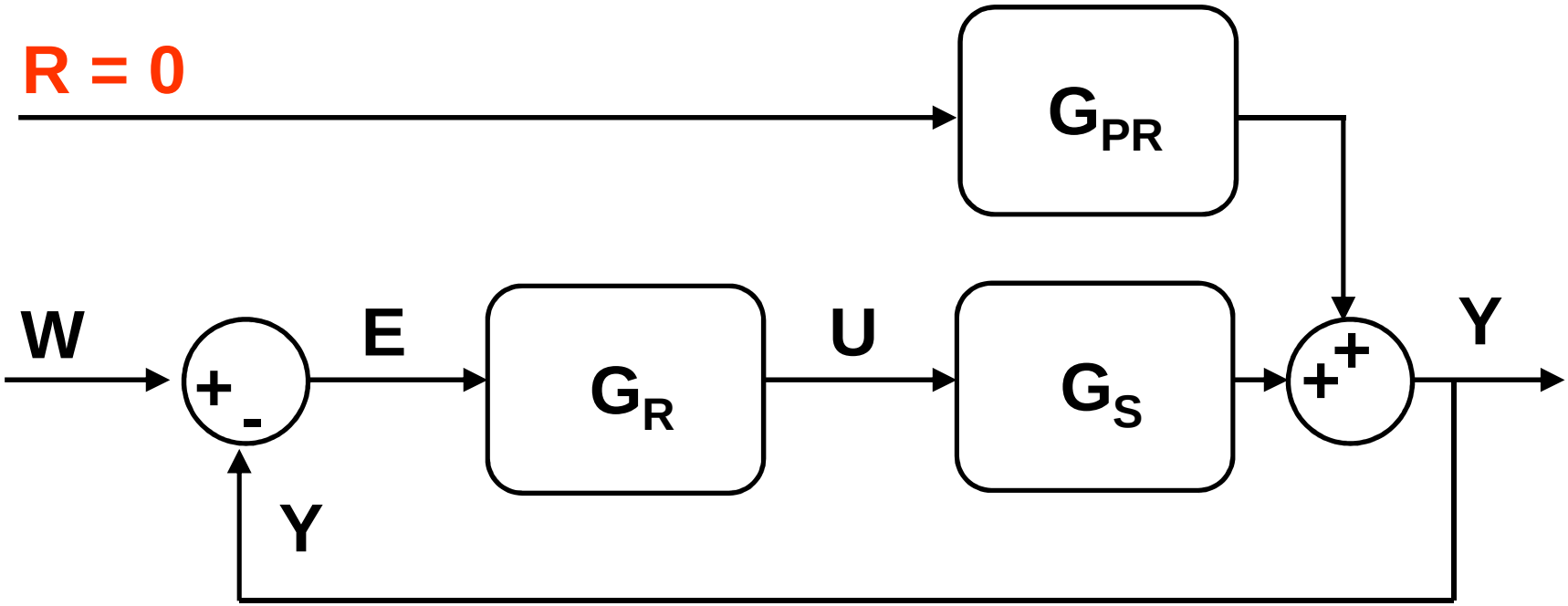
7. Zadanie z LCRP – teoretická časť

- **URO**
- **prenos URO**
- **CHR URO**
- **zákon riadenia**
- **Routhovo-Schurovo kritérium stabiliity**

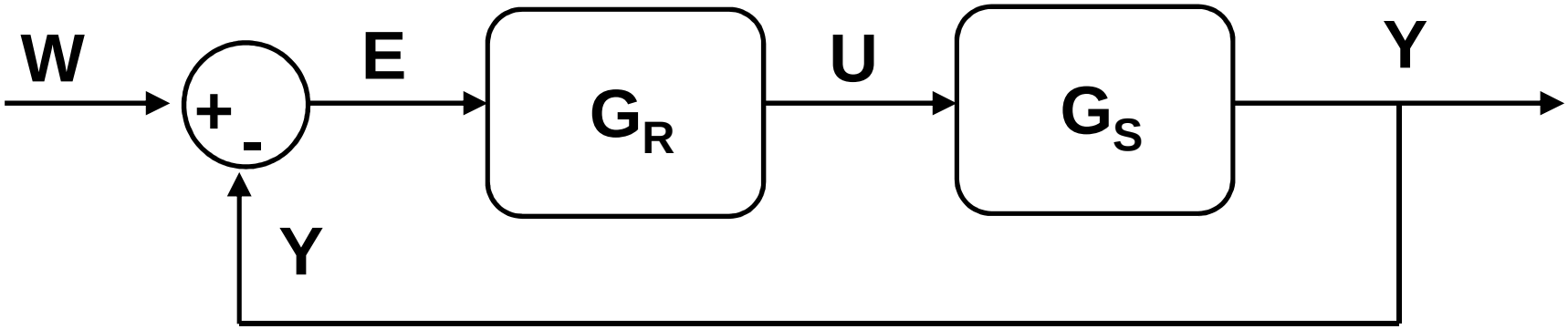
Prenos URO



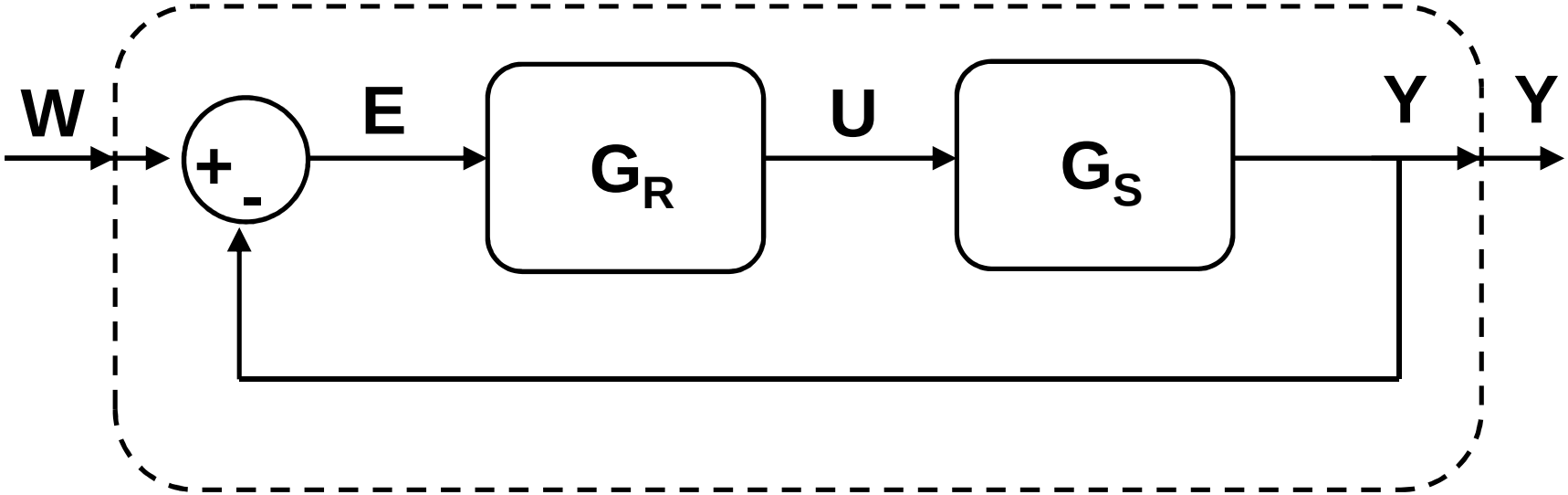
Prenos URO



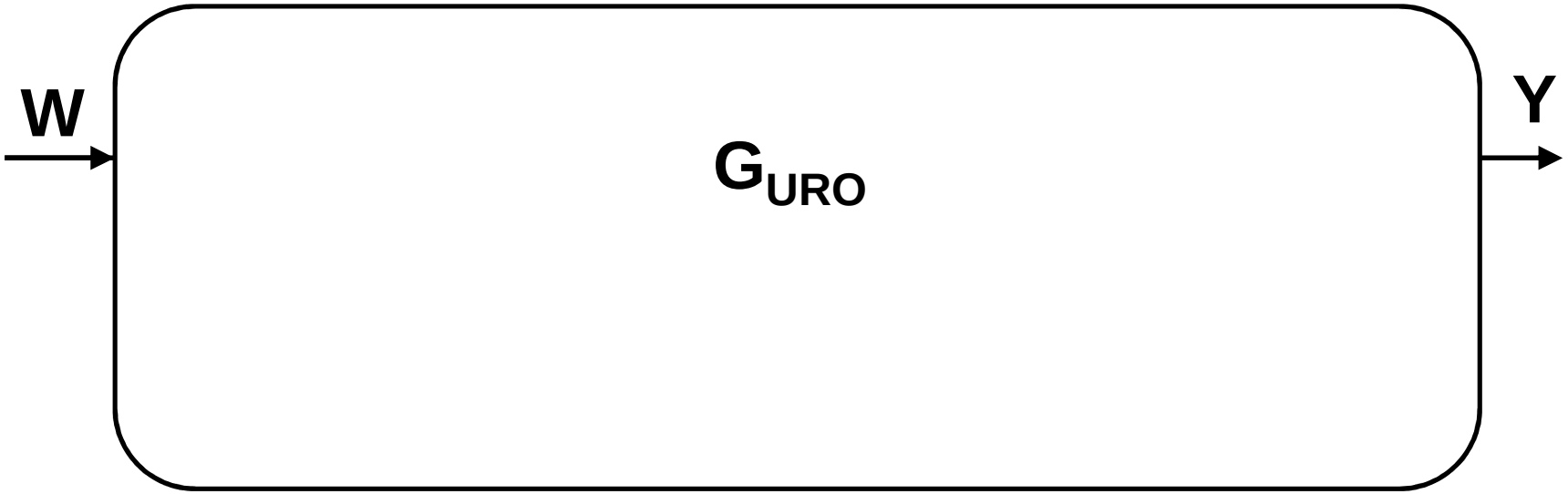
Prenos URO



Prenos URO



Prenos URO



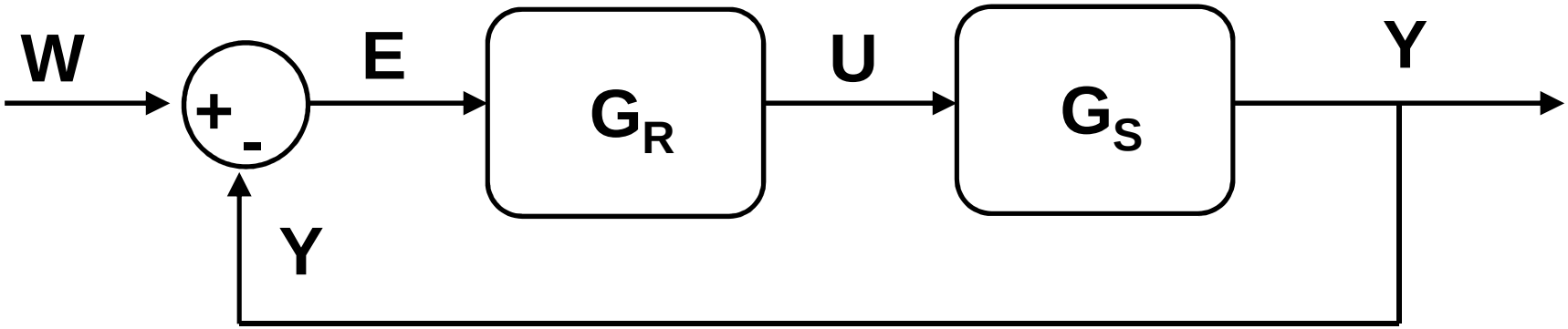
Prenos URO

$$Y = G_{URO}W$$

Prenos URO

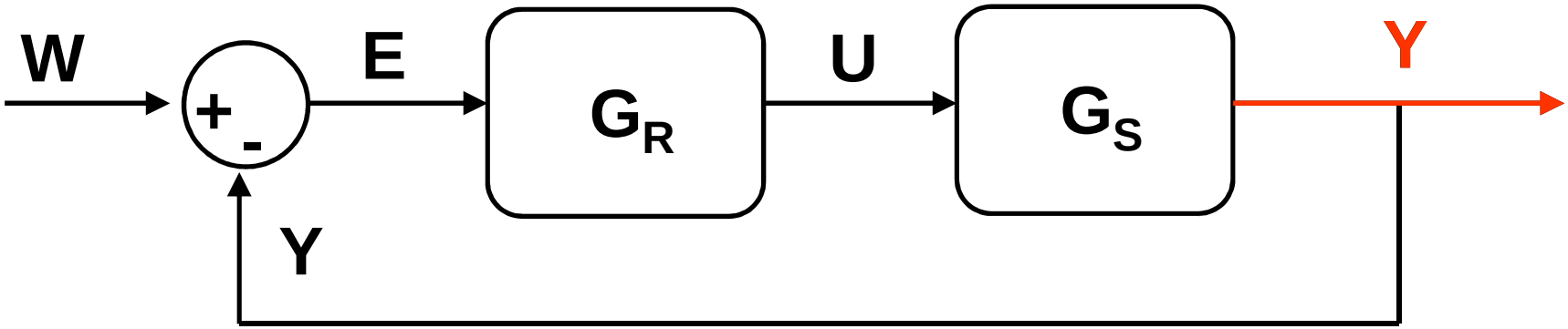
$$Y = \overset{?}{G_{URO}} W$$

Prenos URO



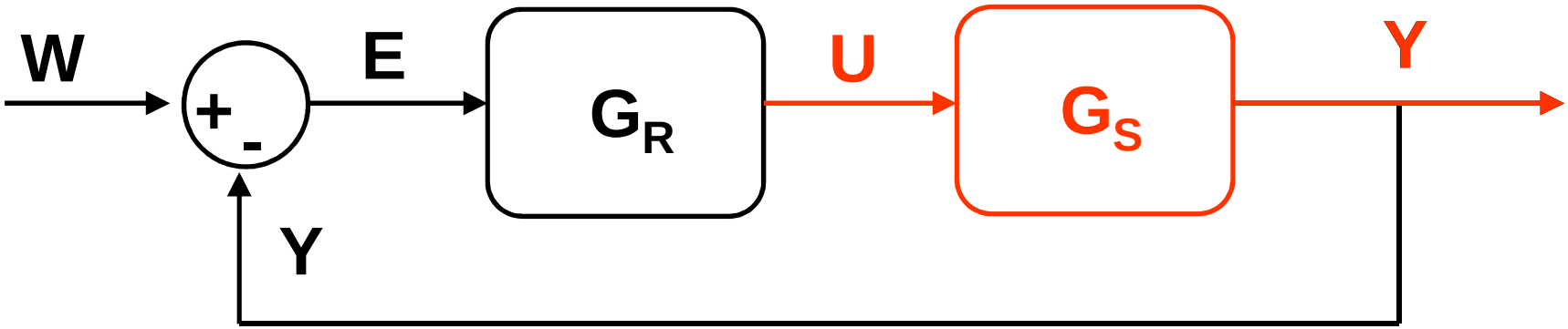
$$Y = \overset{?}{G_{URO}} W$$

Prenos URO



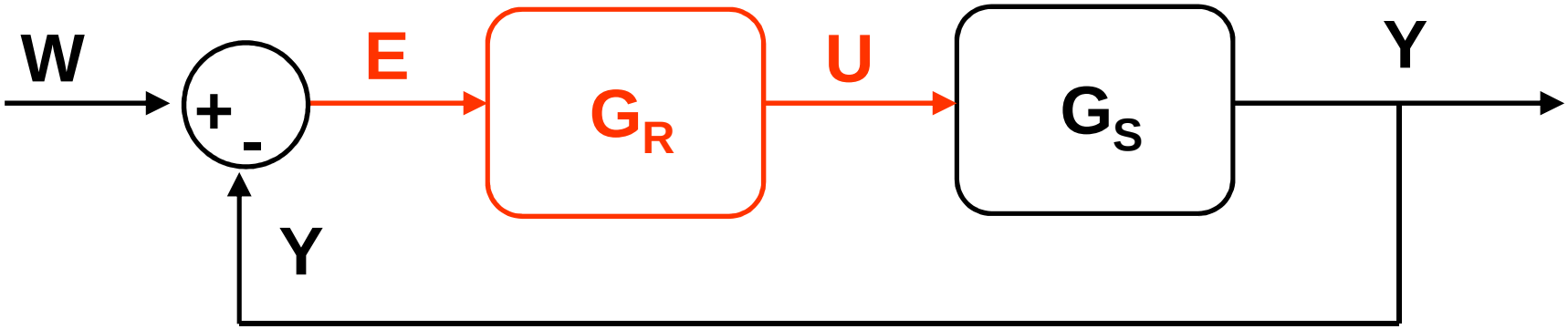
Y

Prenos URO



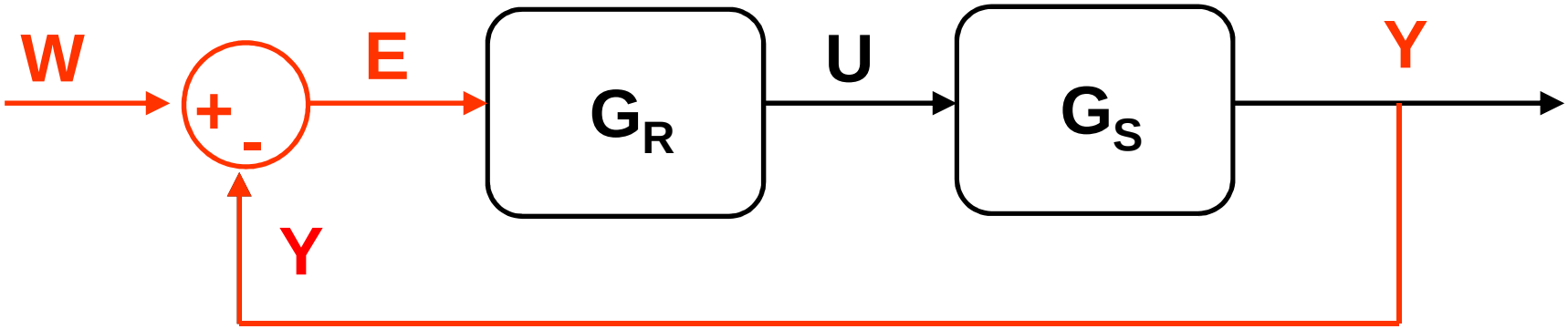
$Y = G_S U$

Prenos URO



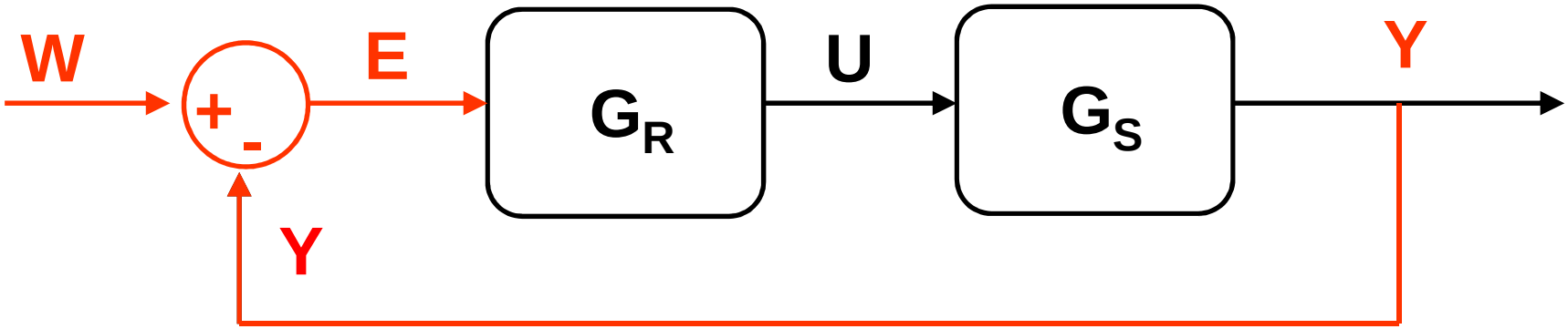
$$Y = G_S U = G_S G_R E$$

Prenos URO



$$Y = G_S U = G_S G_R E = G_S G_R (W - Y)$$

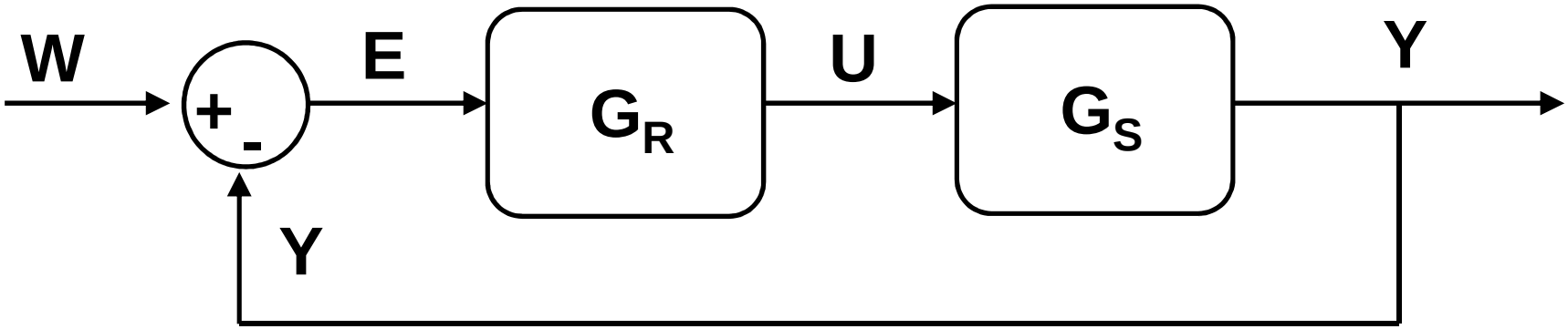
Prenos URO



$$Y = G_S U = G_S G_R E = G_S G_R (W - Y) =$$

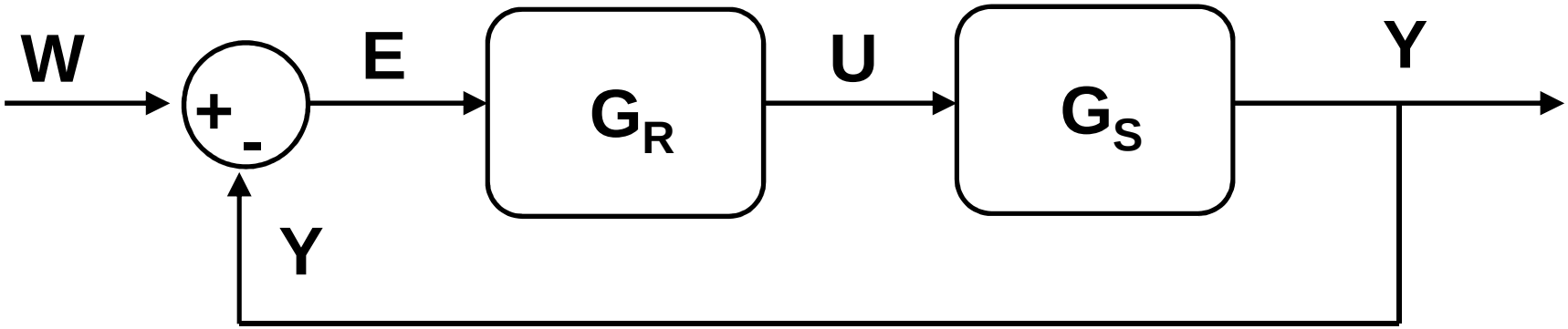
$$= G_S G_R W - G_S G_R Y$$

Prenos URO



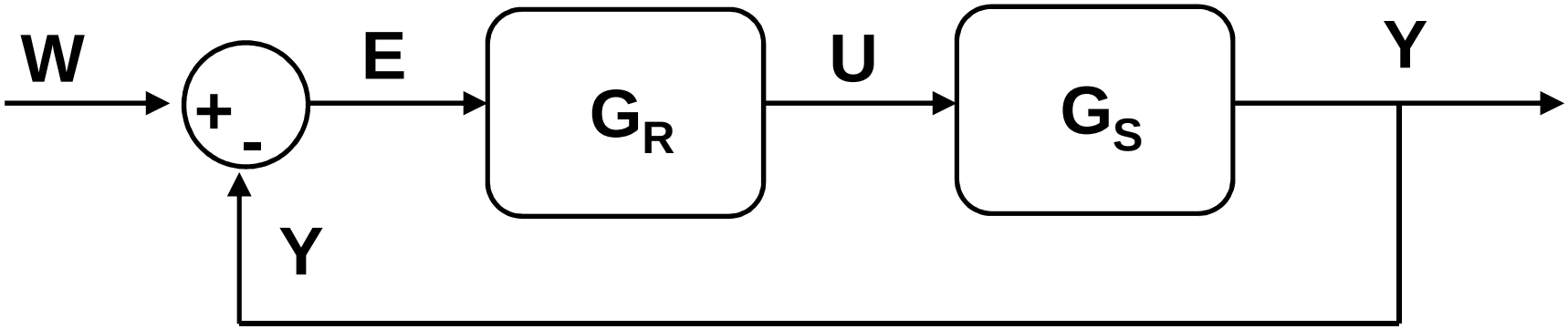
$$Y = G_S G_R W - G_S G_R Y$$

Prenos URO



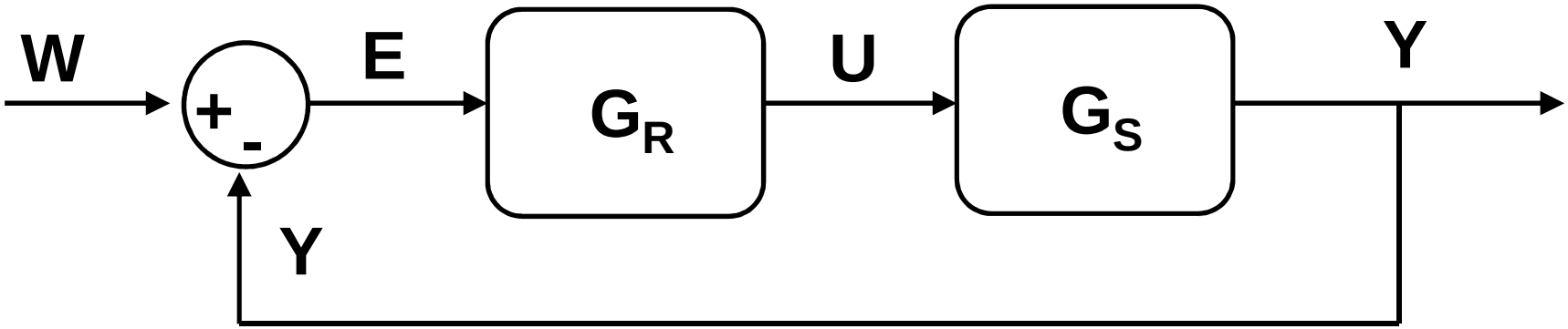
$$Y = G_S G_R W - G_S G_R Y \quad / + G_S G_R Y$$

Prenos URO



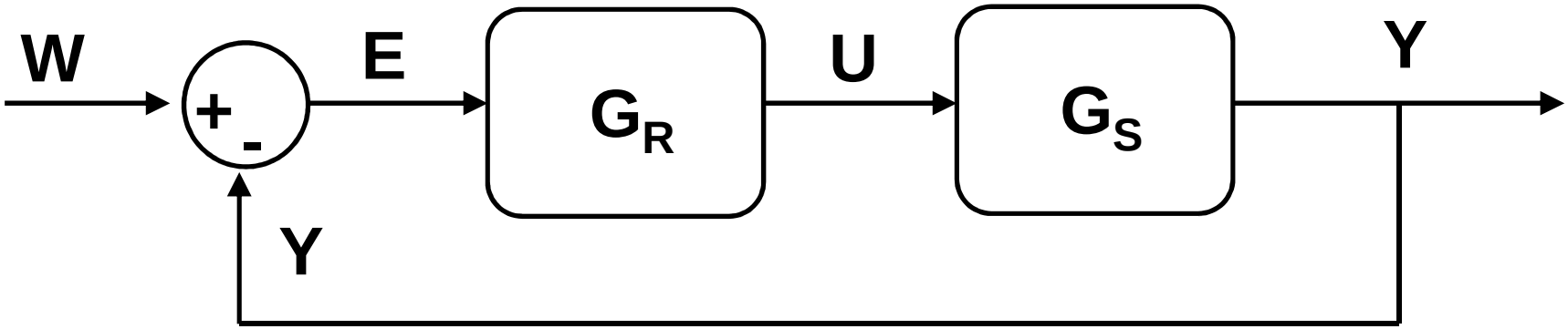
$$Y + G_S G_R Y = G_S G_R W$$

Prenos URO



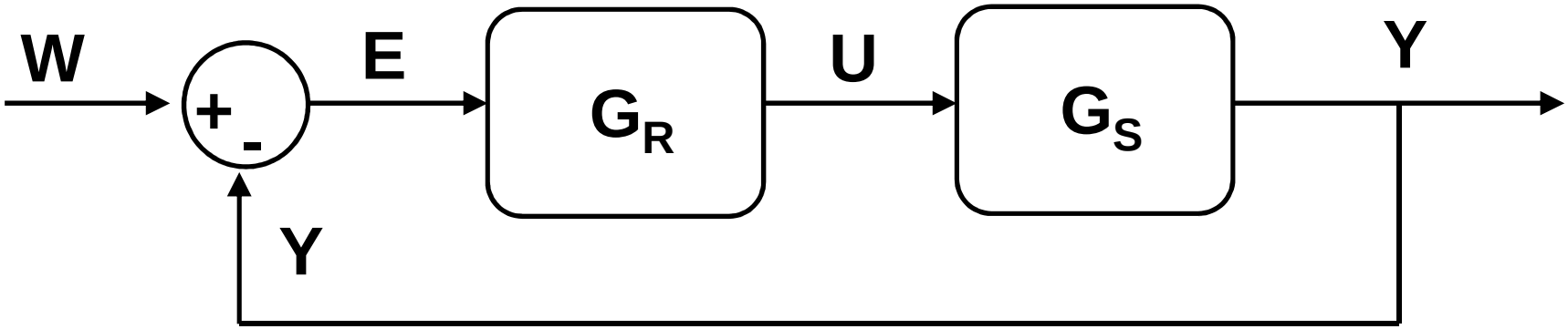
$$Y(1 + G_S G_R) = G_S G_R W$$

Prenos URO



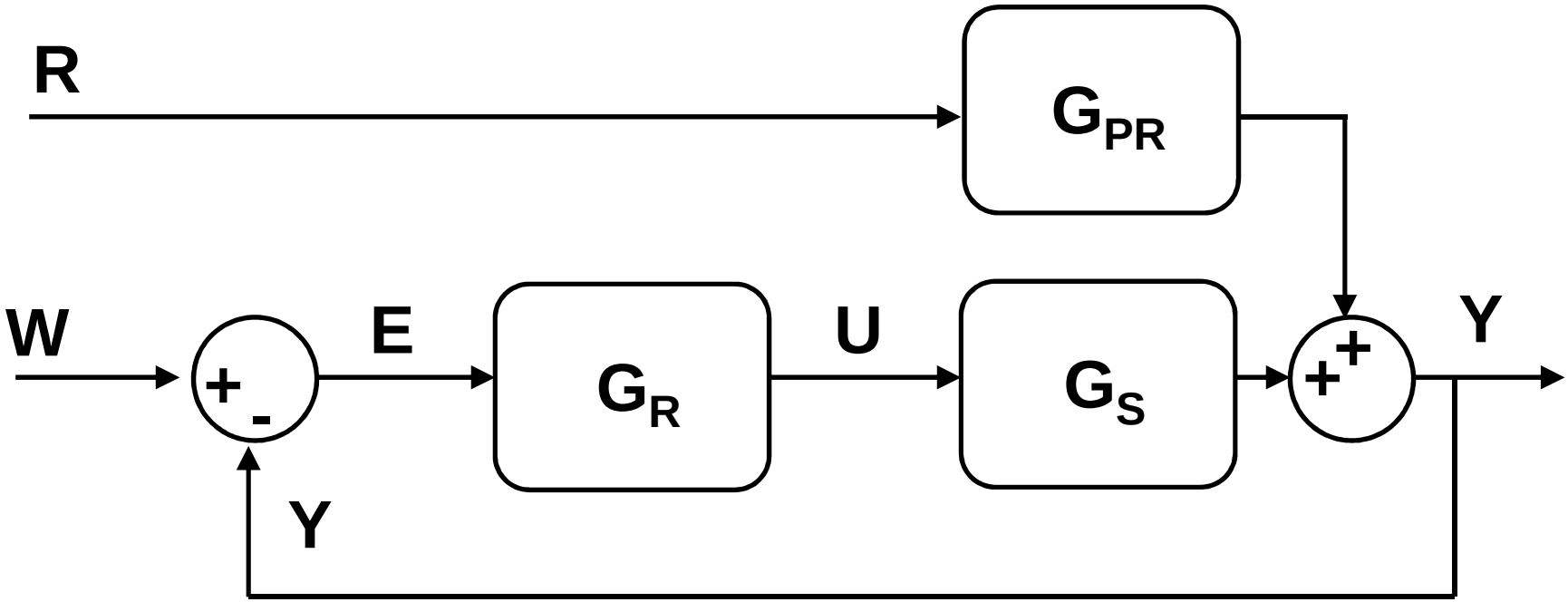
$$Y / W = G_S G_R / (1 + G_S G_R)$$

Prenos URO

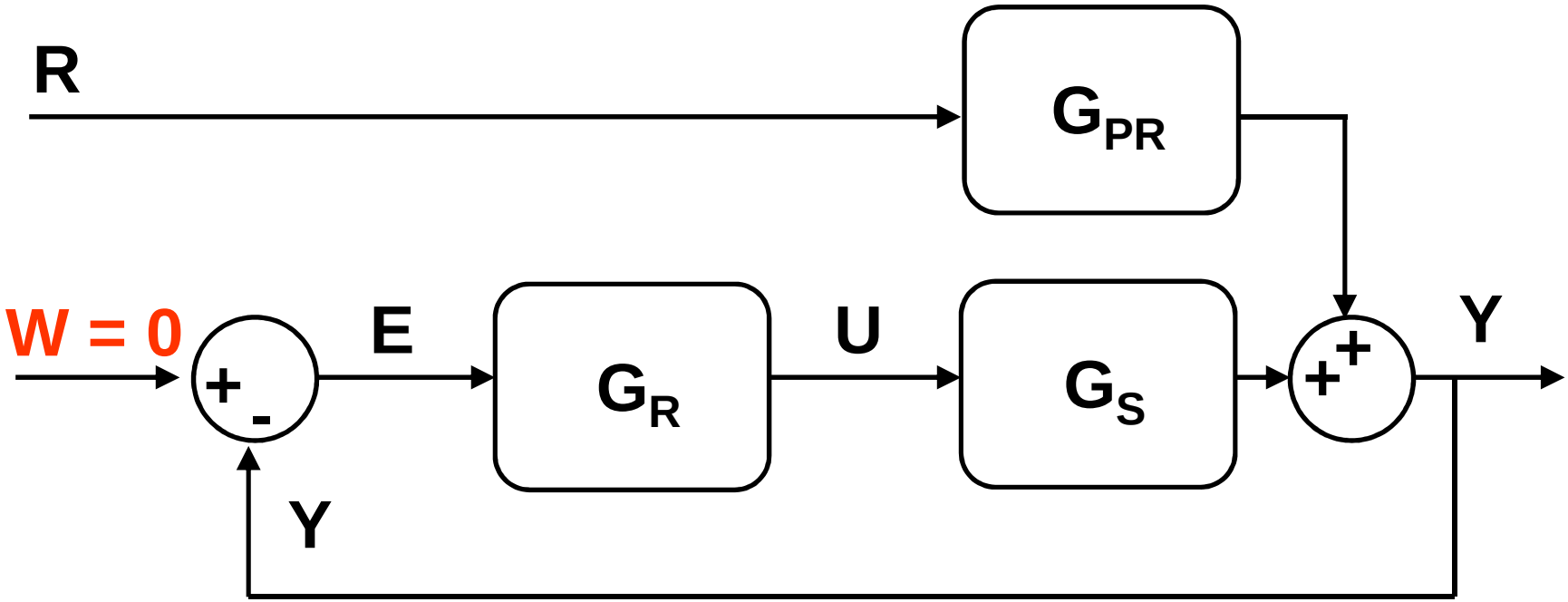


$$G_{URO} = \frac{Y}{W} = \frac{G_R G_S}{1 + G_R G_S}$$

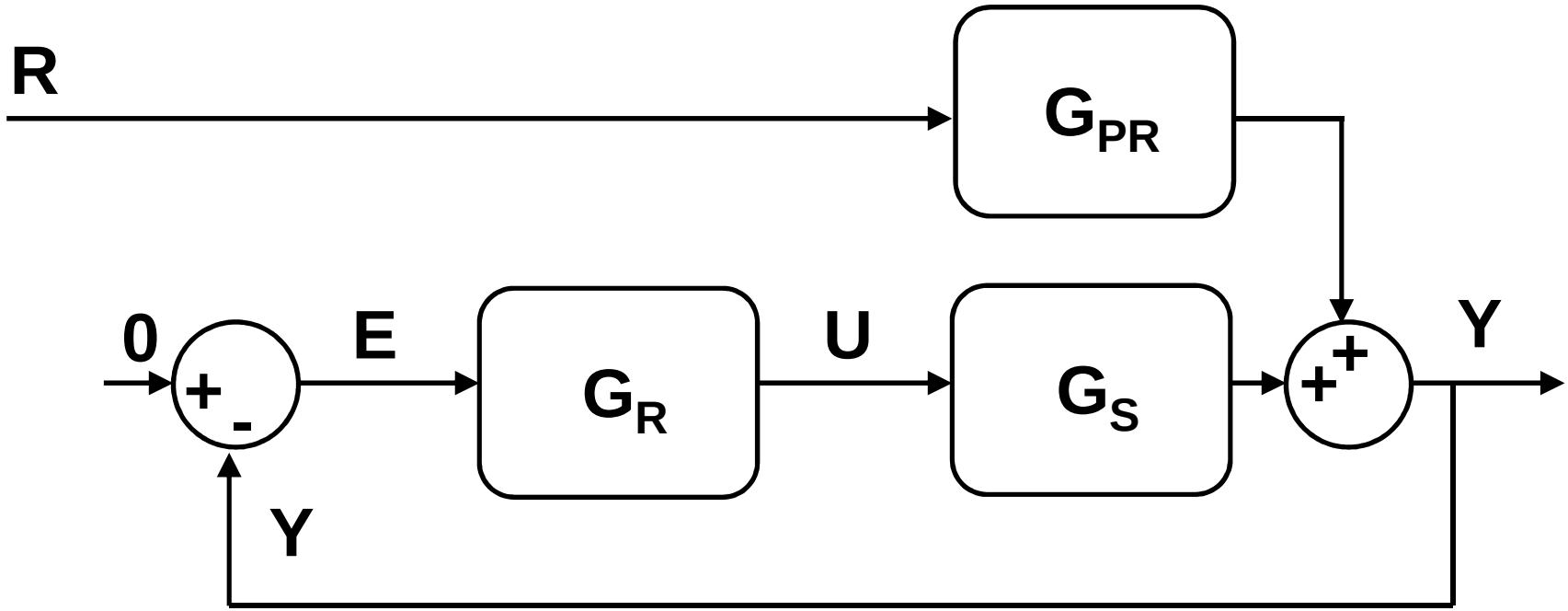
Prenos URO



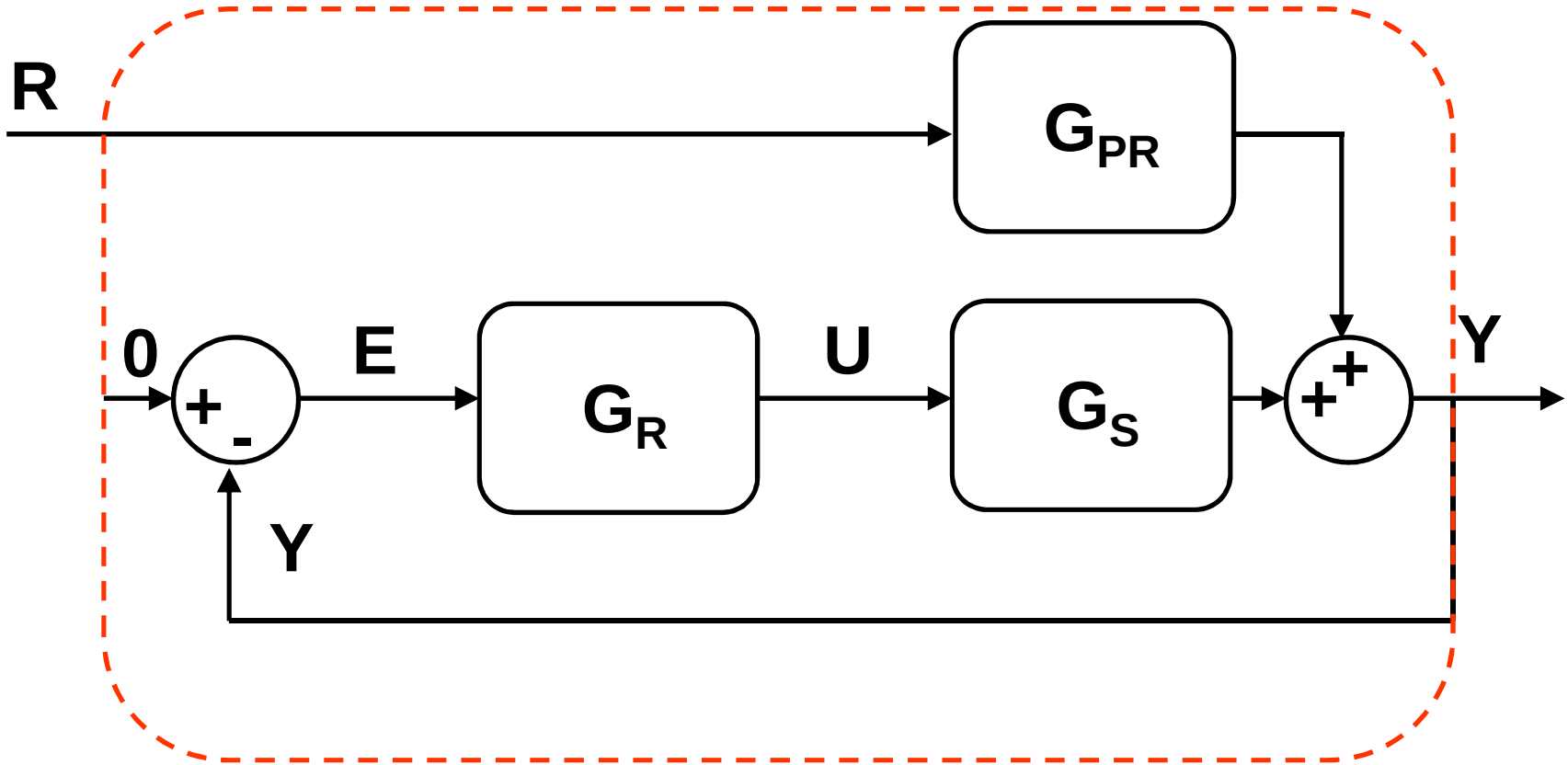
Prenos URO



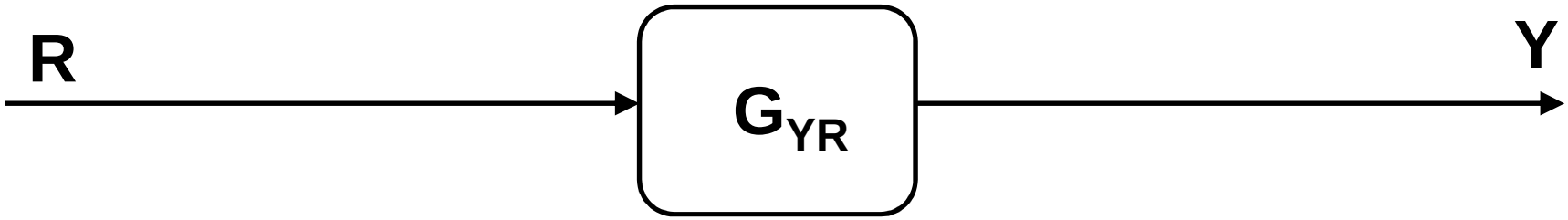
Prenos URO



Prenos URO

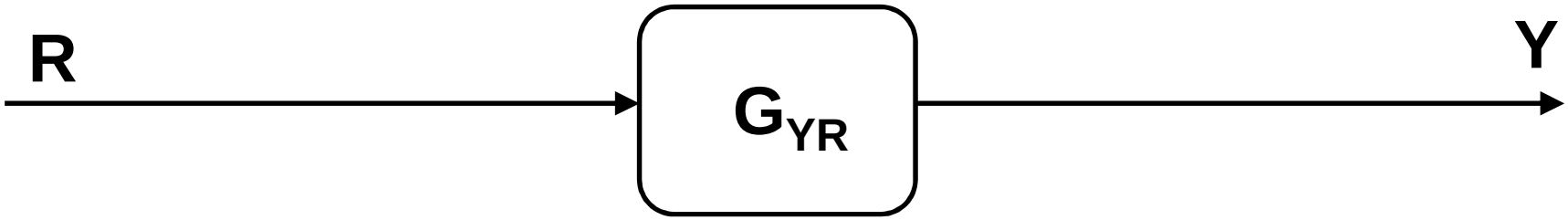


Prenos URO



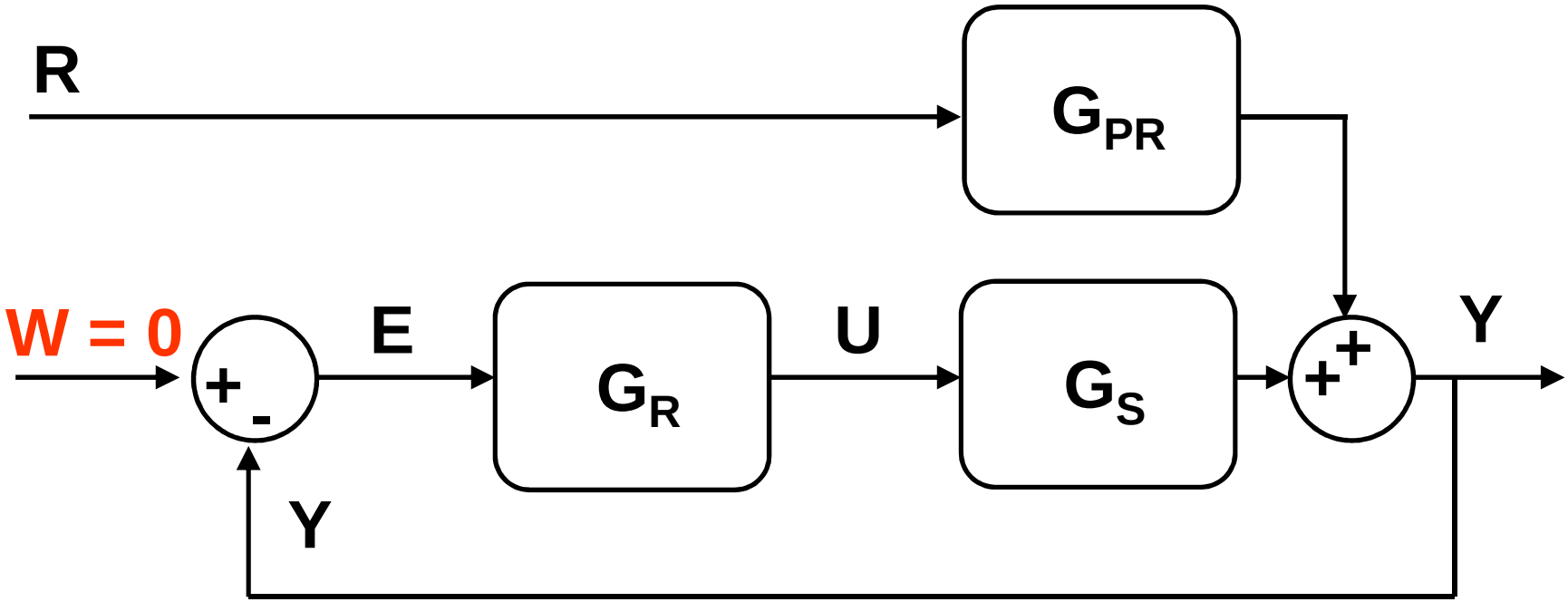
$$Y = G_{YR}R$$

Prenos URO

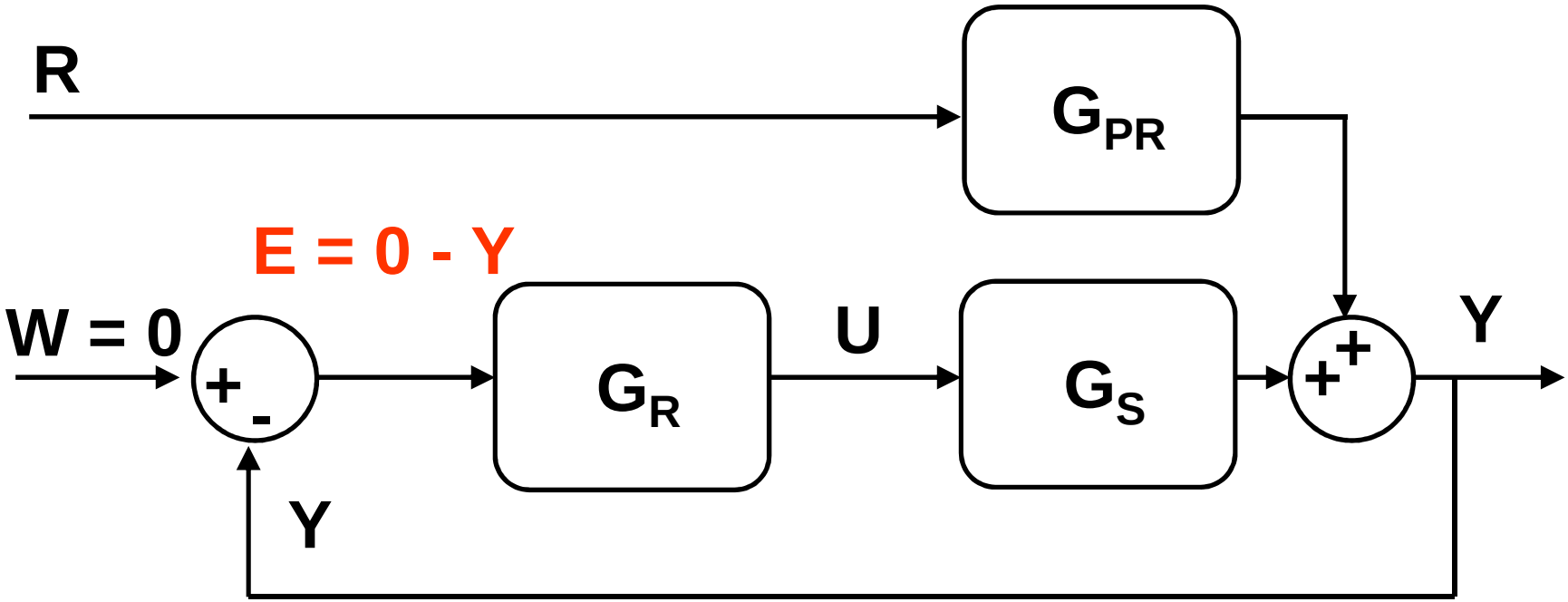


$$Y = G_{YR}^{?} R$$

Prenos URO



Prenos URO



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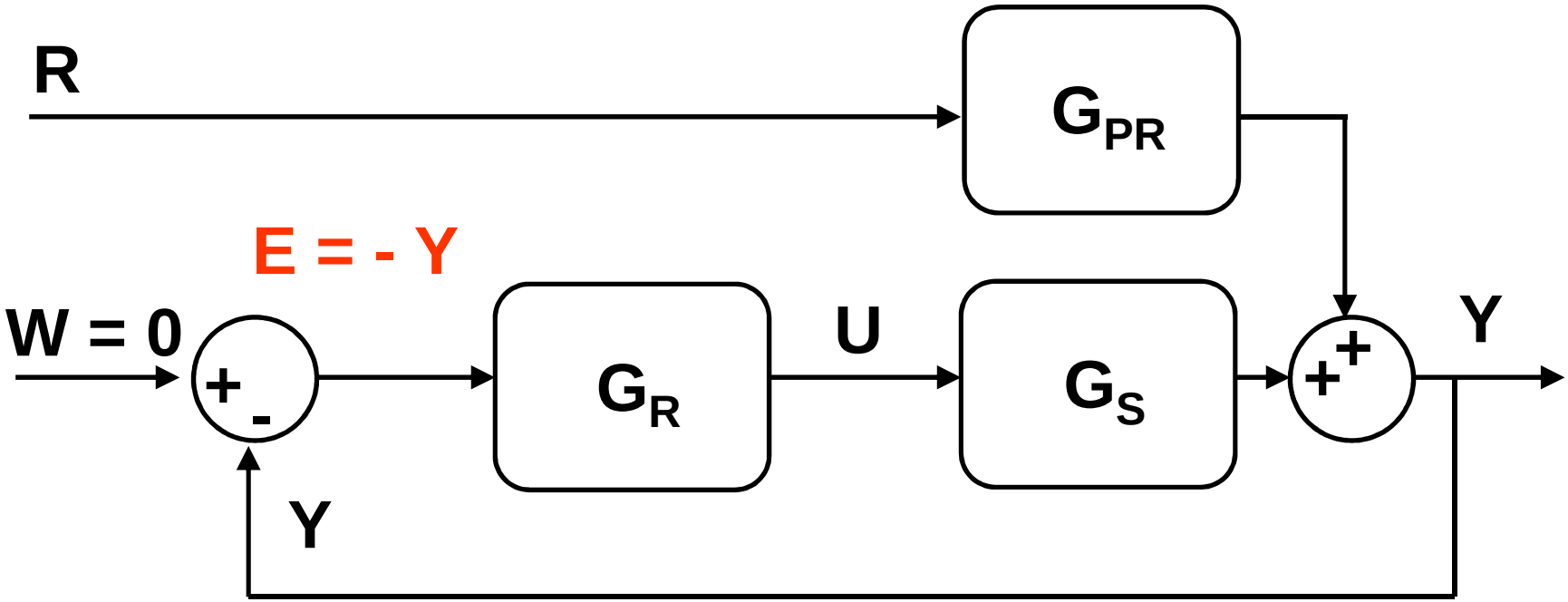

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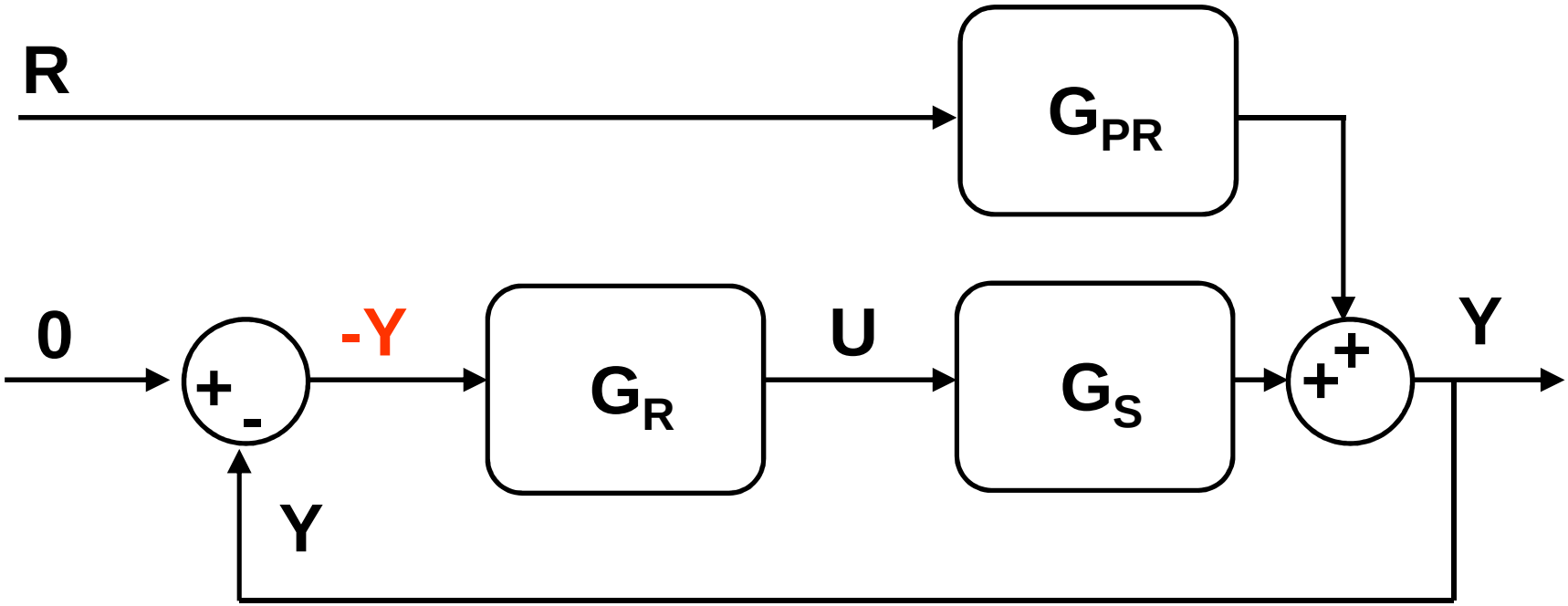

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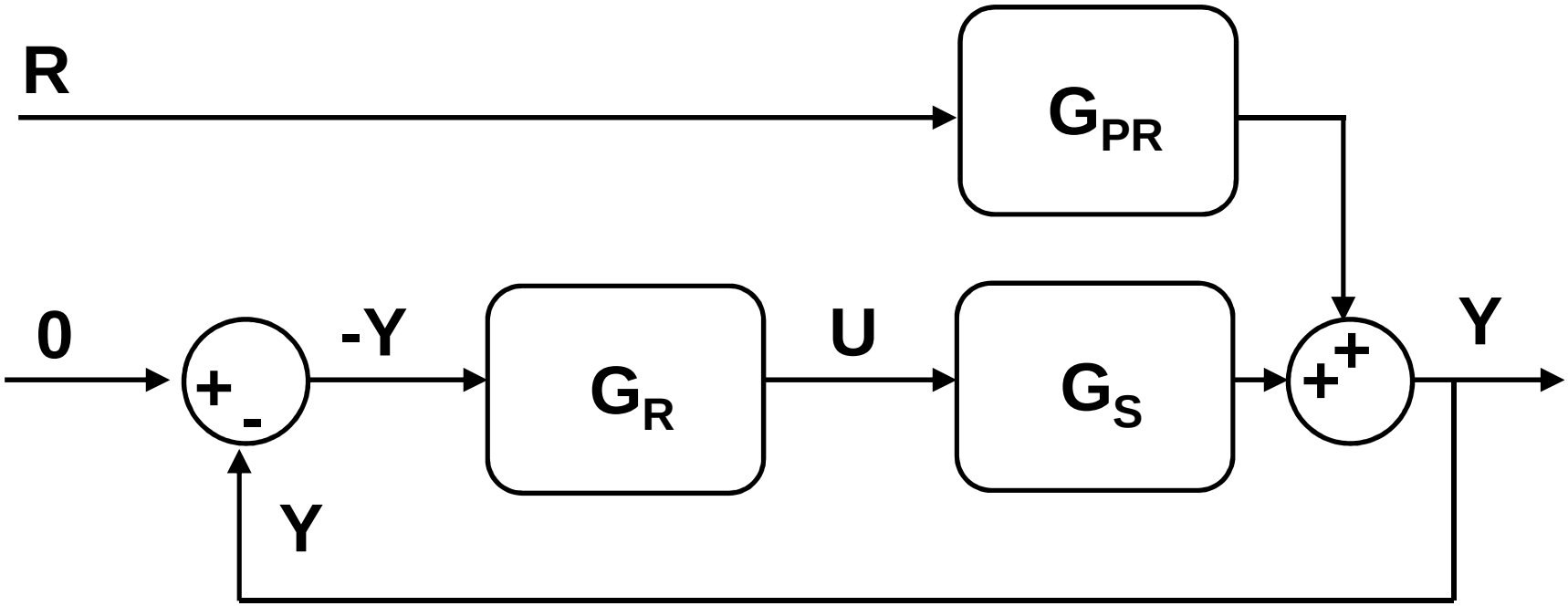
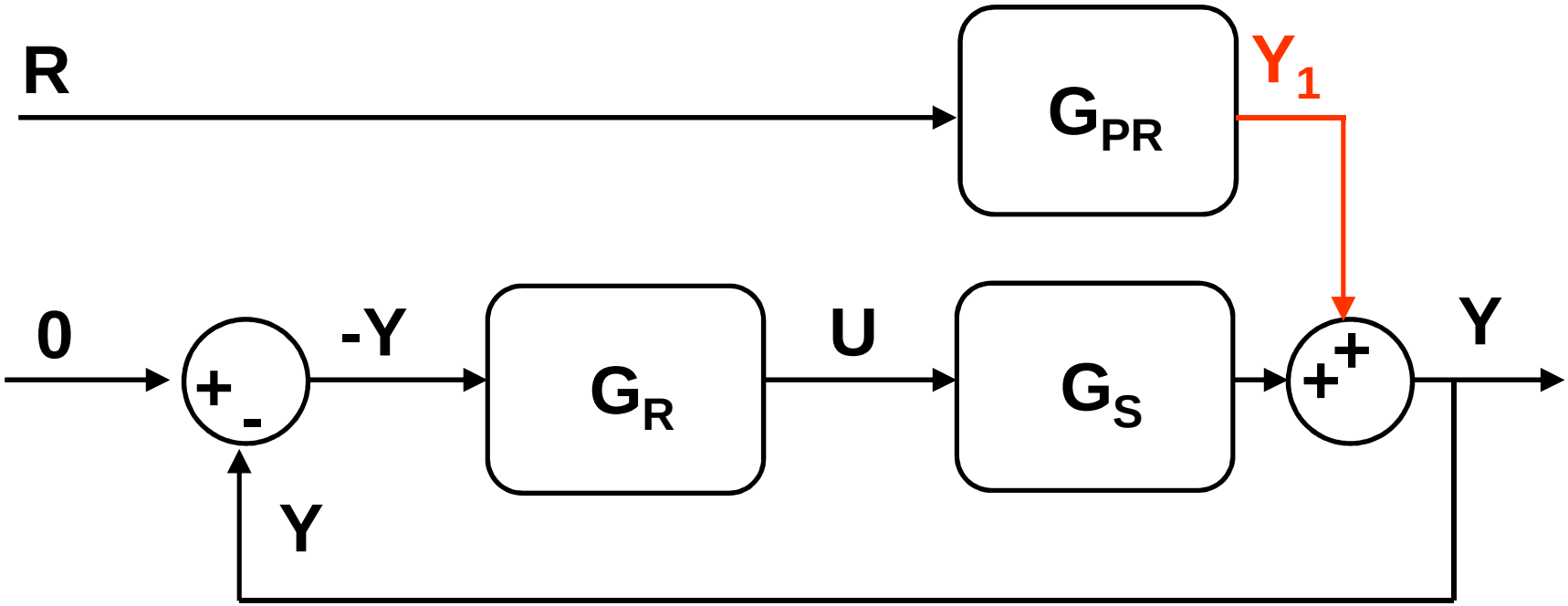
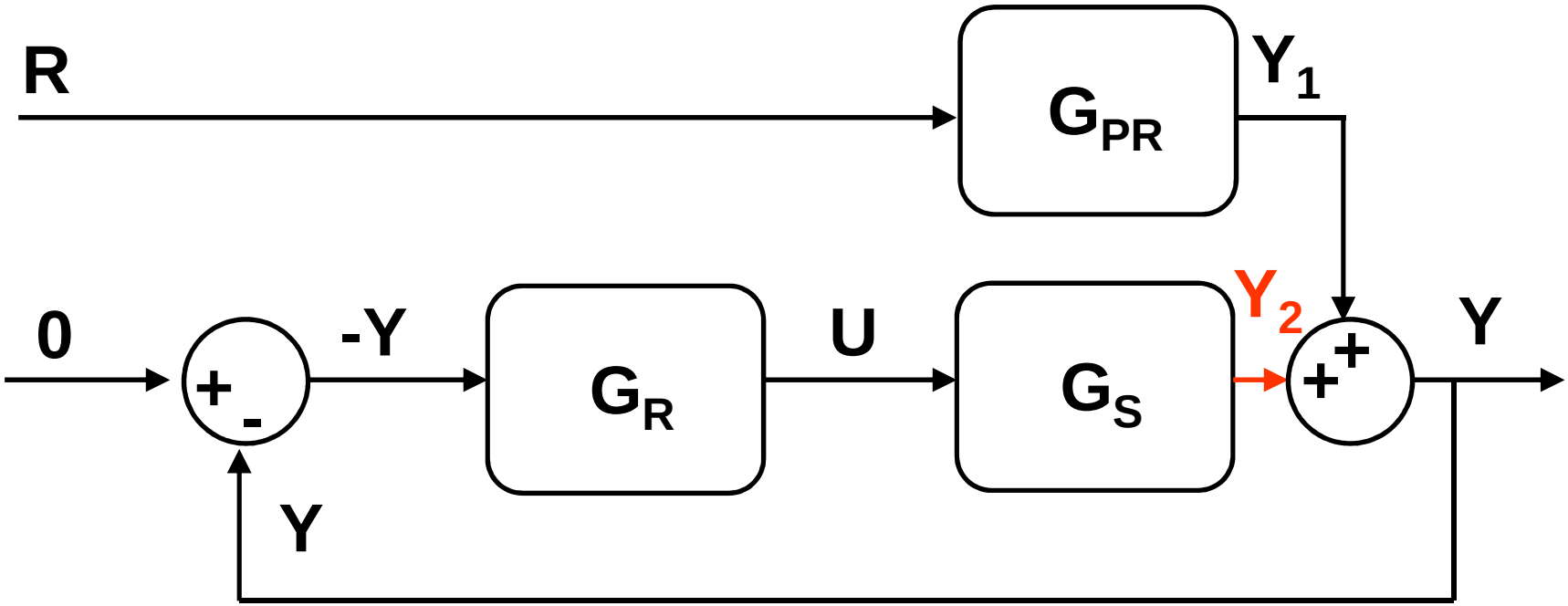


Prenos URO



Prenos URO



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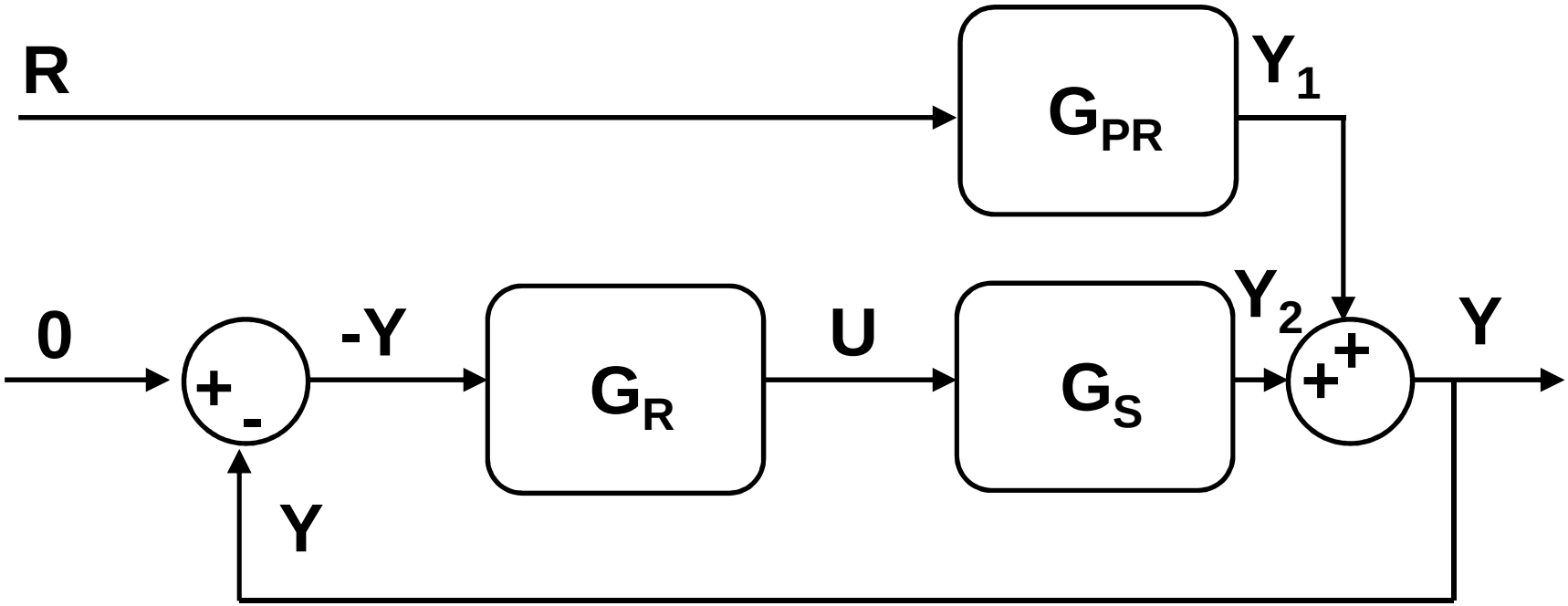

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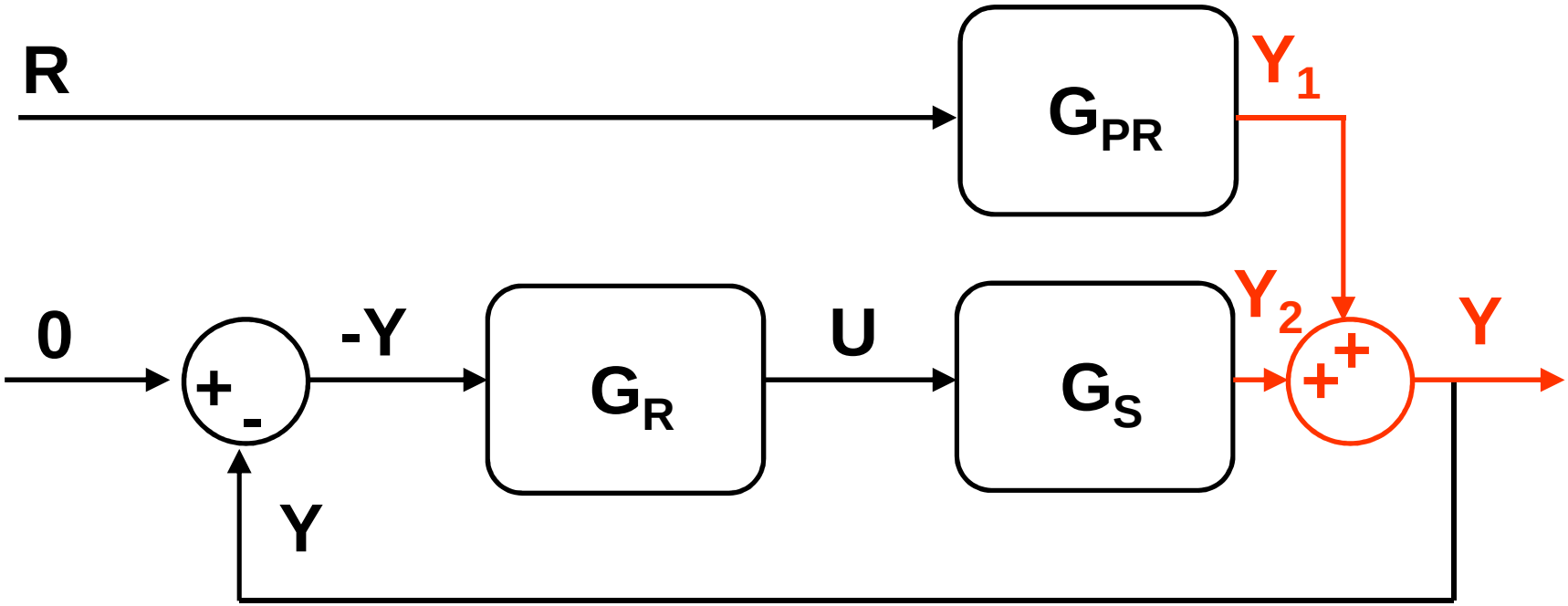
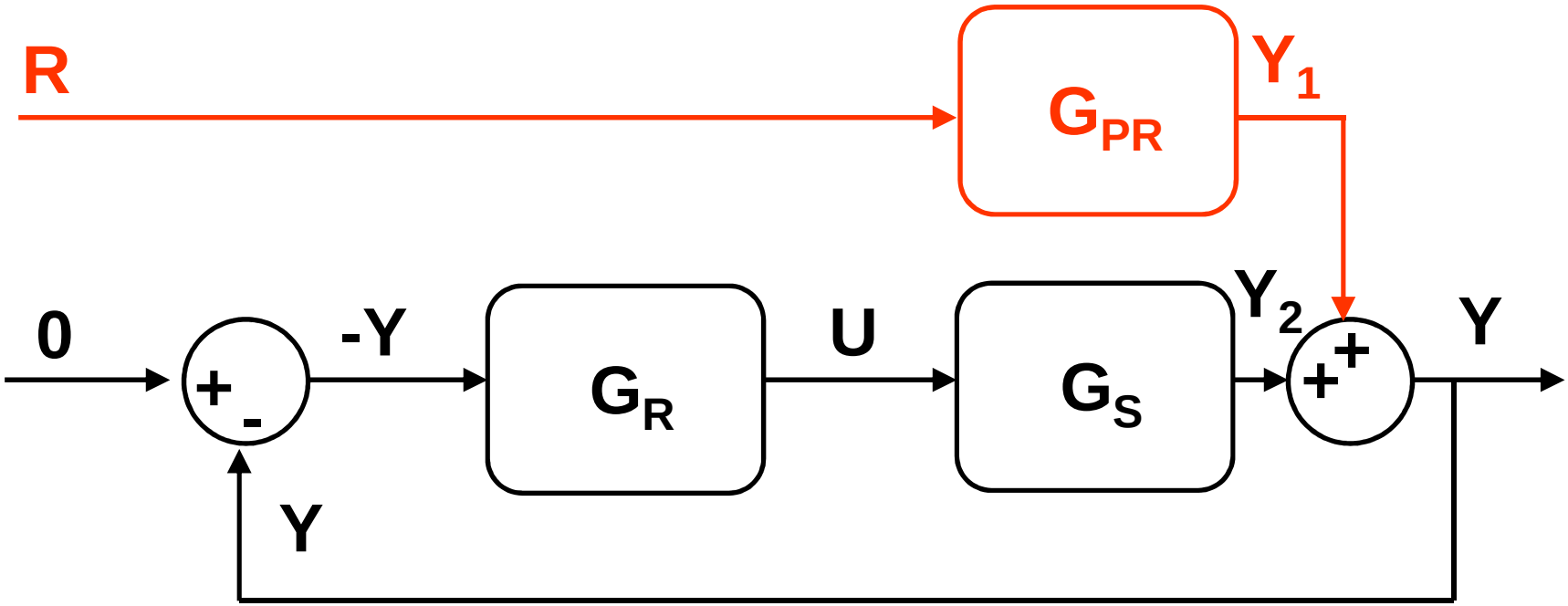


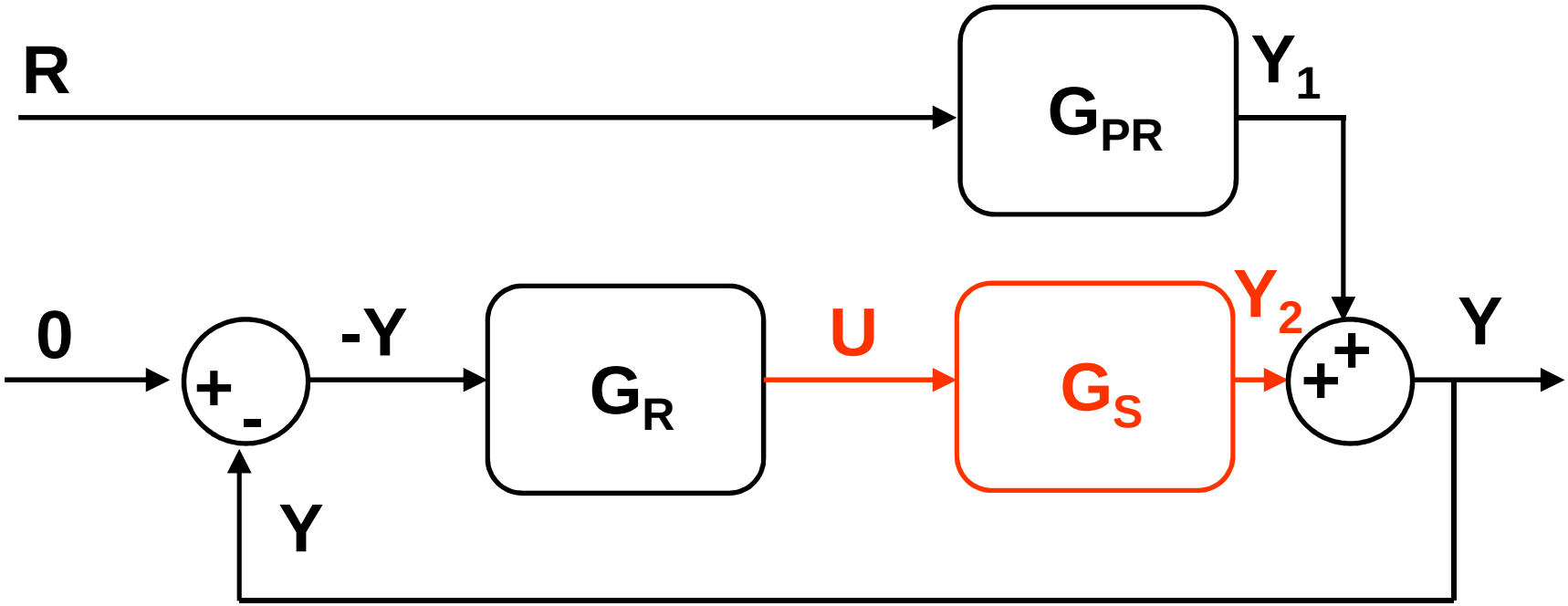
$Y = Y_1 + Y_2$

Prenos URO



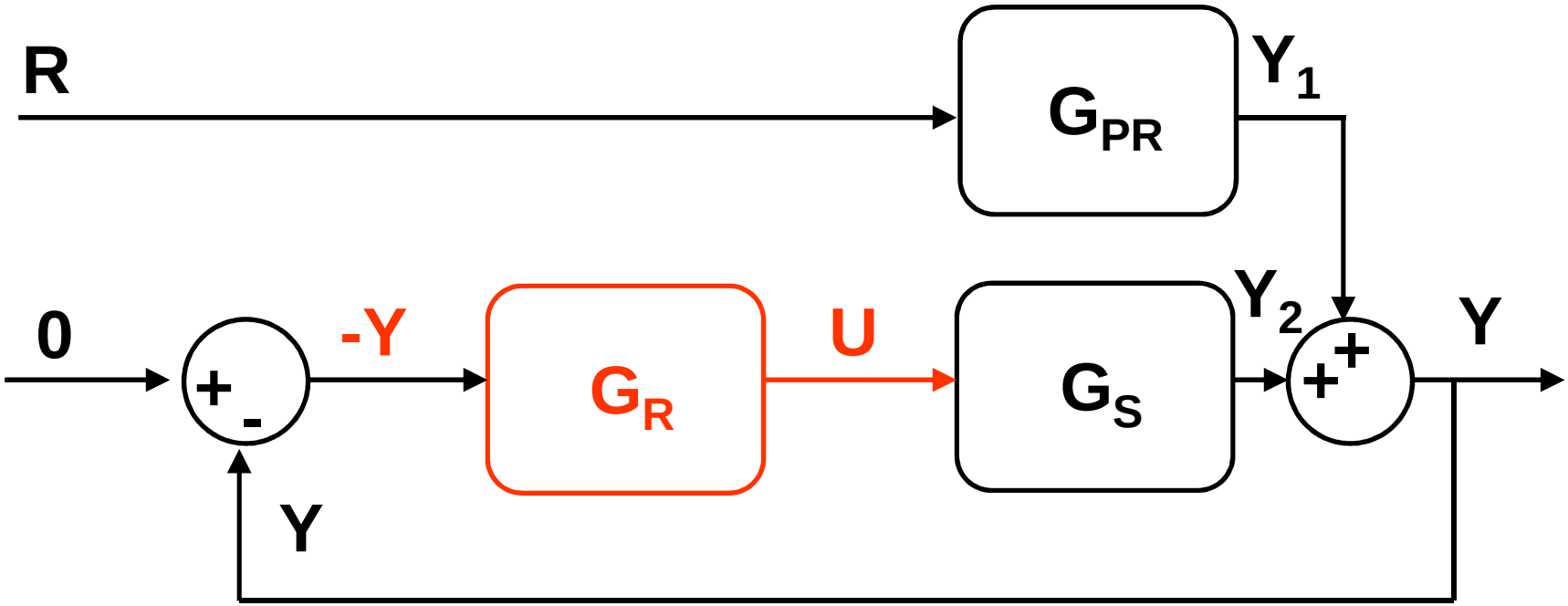
$$Y = Y_1 + Y_2 = G_{PR}R + Y_2$$

Prenos URO



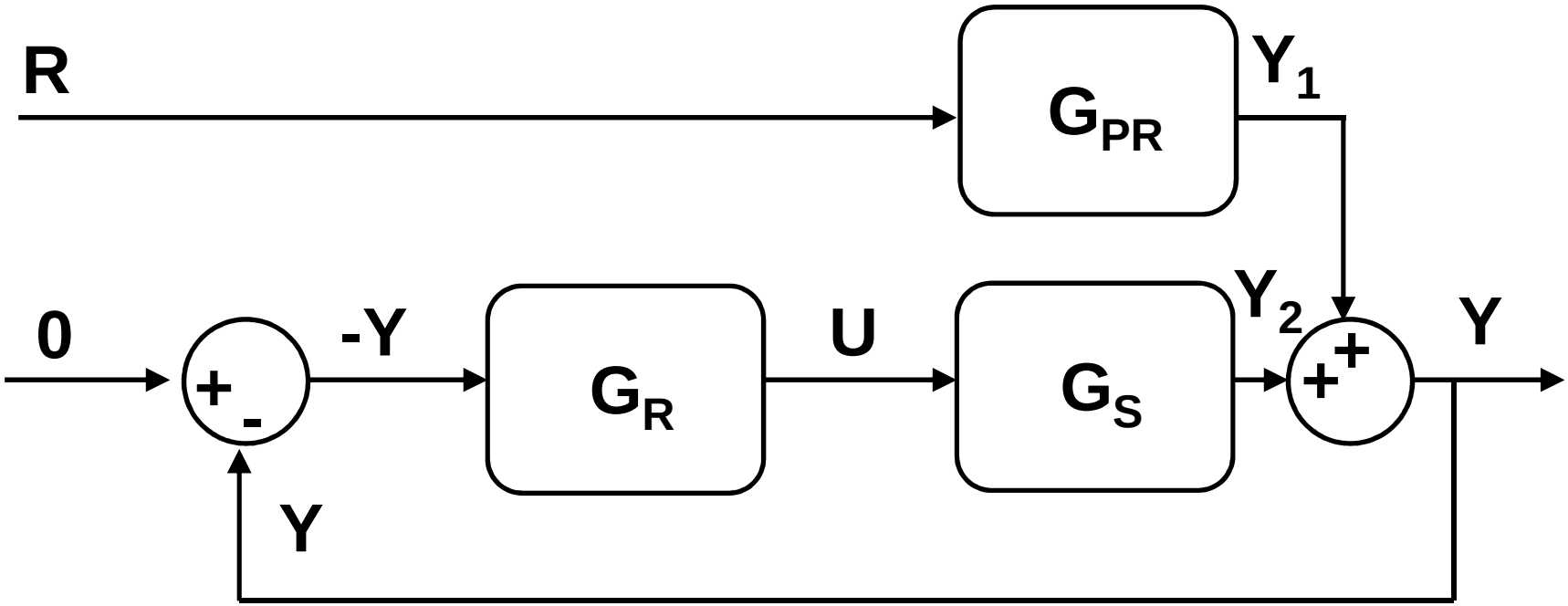
$$Y = Y_1 + Y_2 = G_{PR}R + G_SU$$

Prenos URO



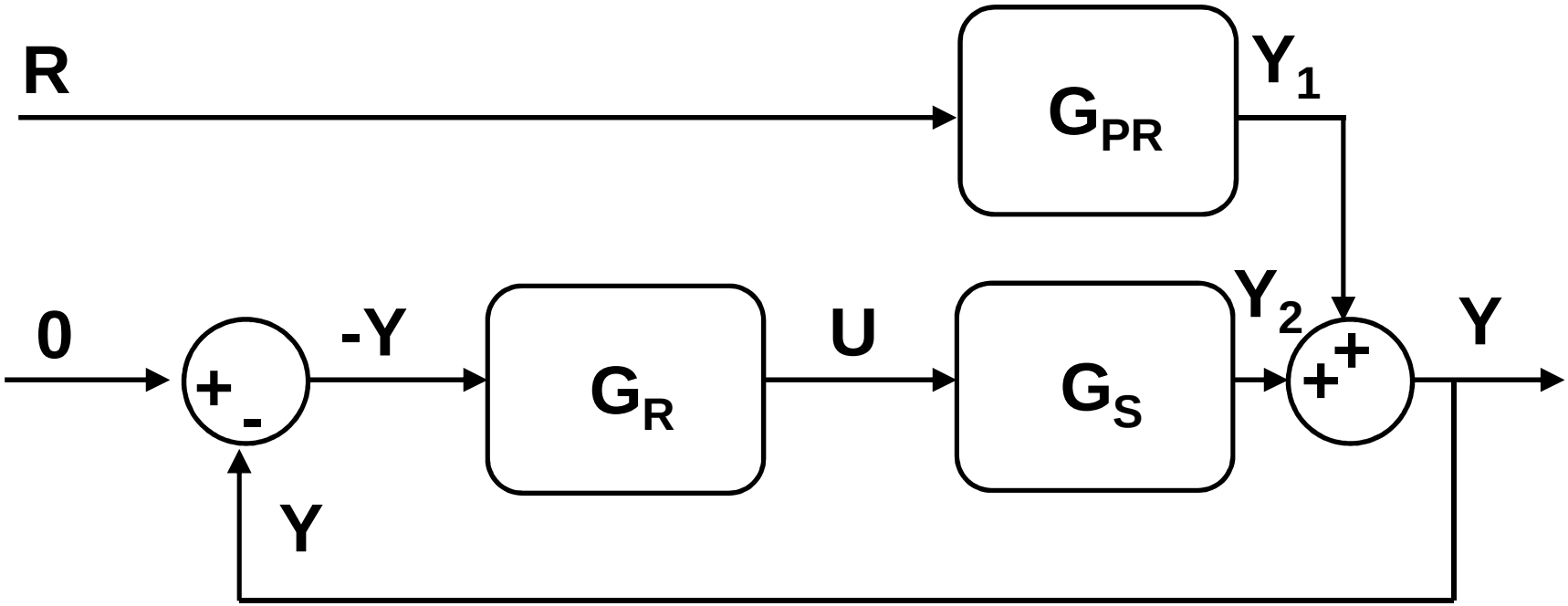
$$Y = Y_1 + Y_2 = G_{PR}R + G_S U = G_{PR}R - G_S G_R Y$$

Prenos URO



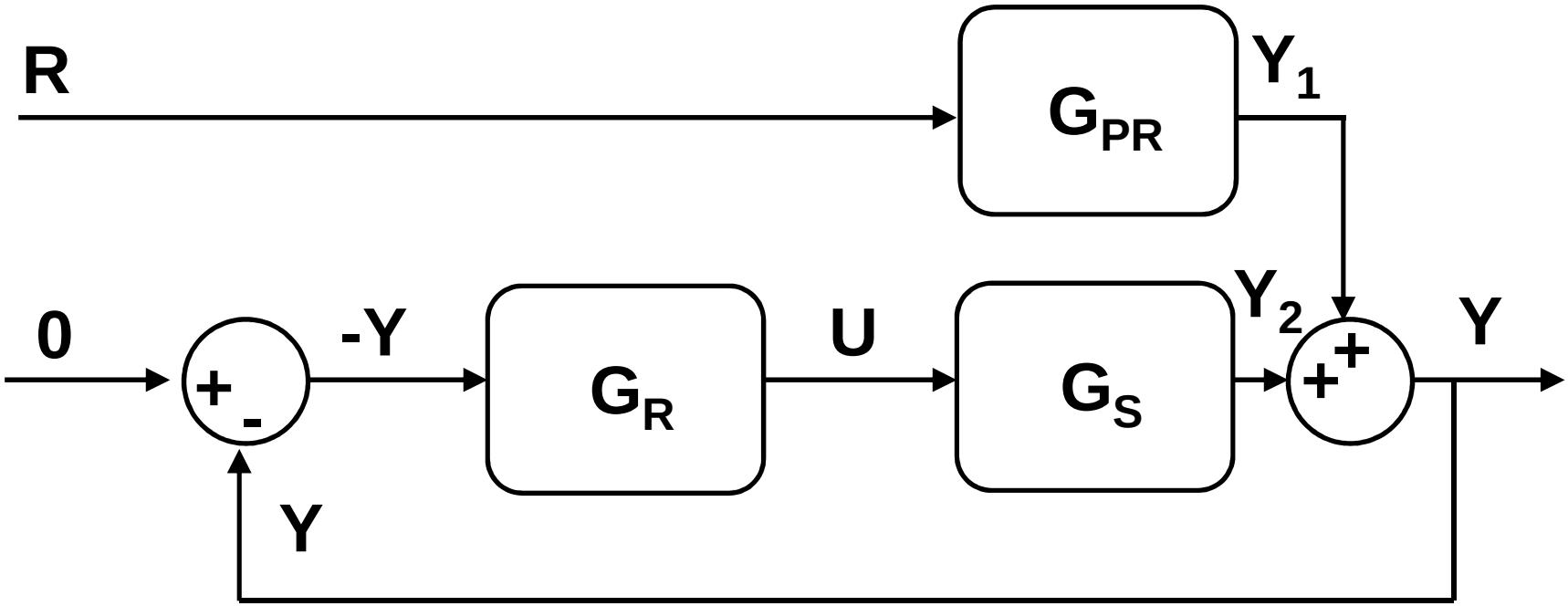
$$Y = Y_1 + Y_2 = G_{PR}R + G_SU = G_{PR}R - G_SG_RY$$

Prenos URO



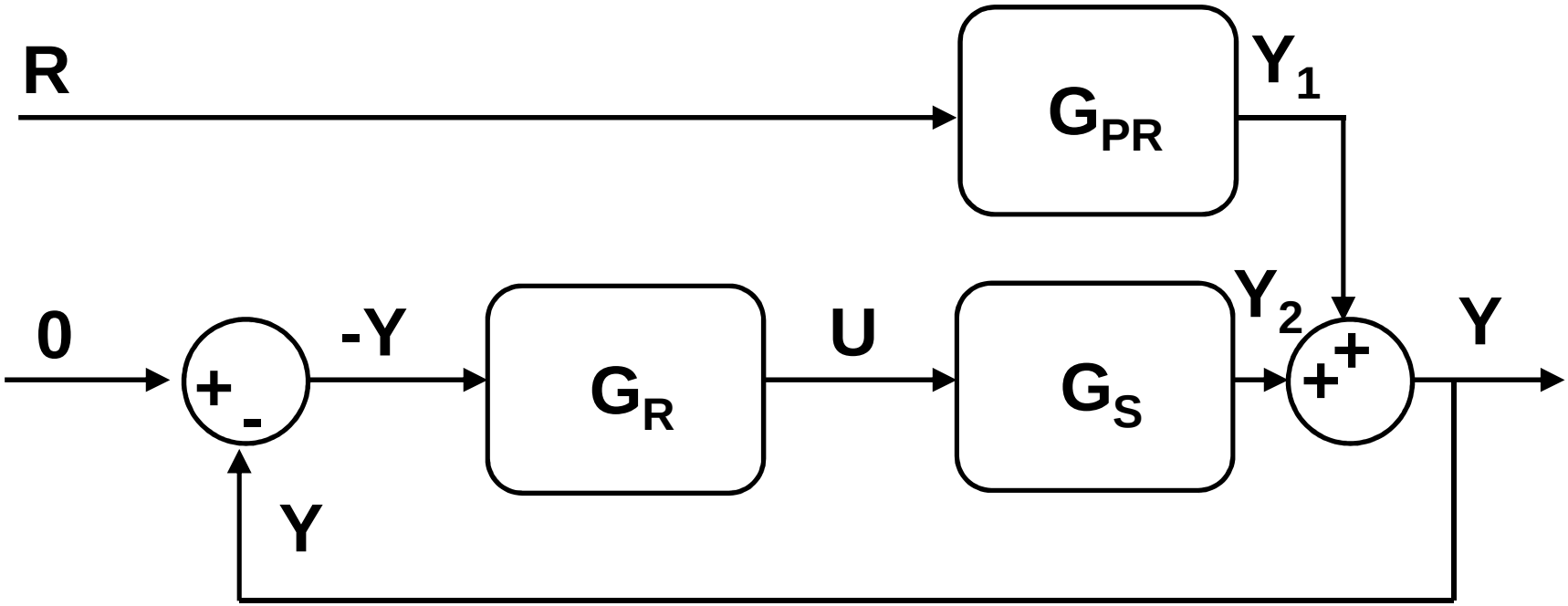
$$Y = G_{PR}R - G_S G_R Y$$

Prenos URO



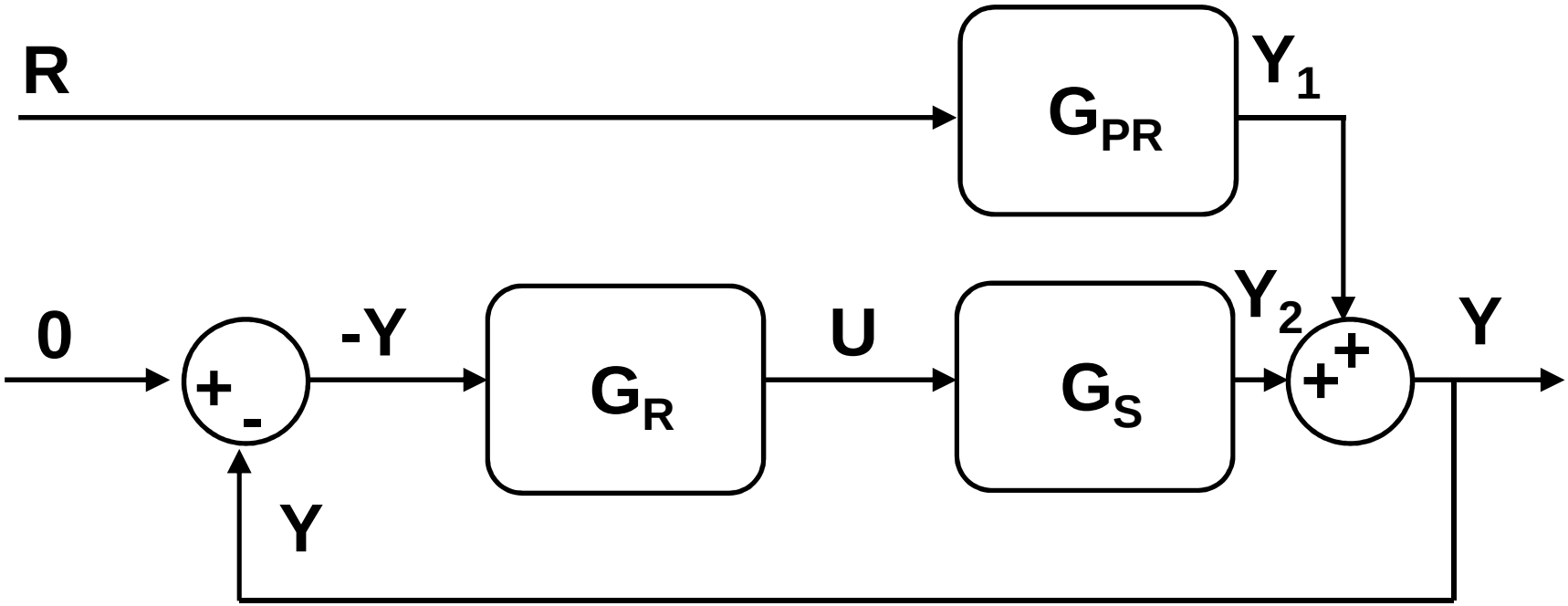
$$Y = G_{PR}R - G_SG_RY \quad / + G_SG_RY$$

Prenos URO



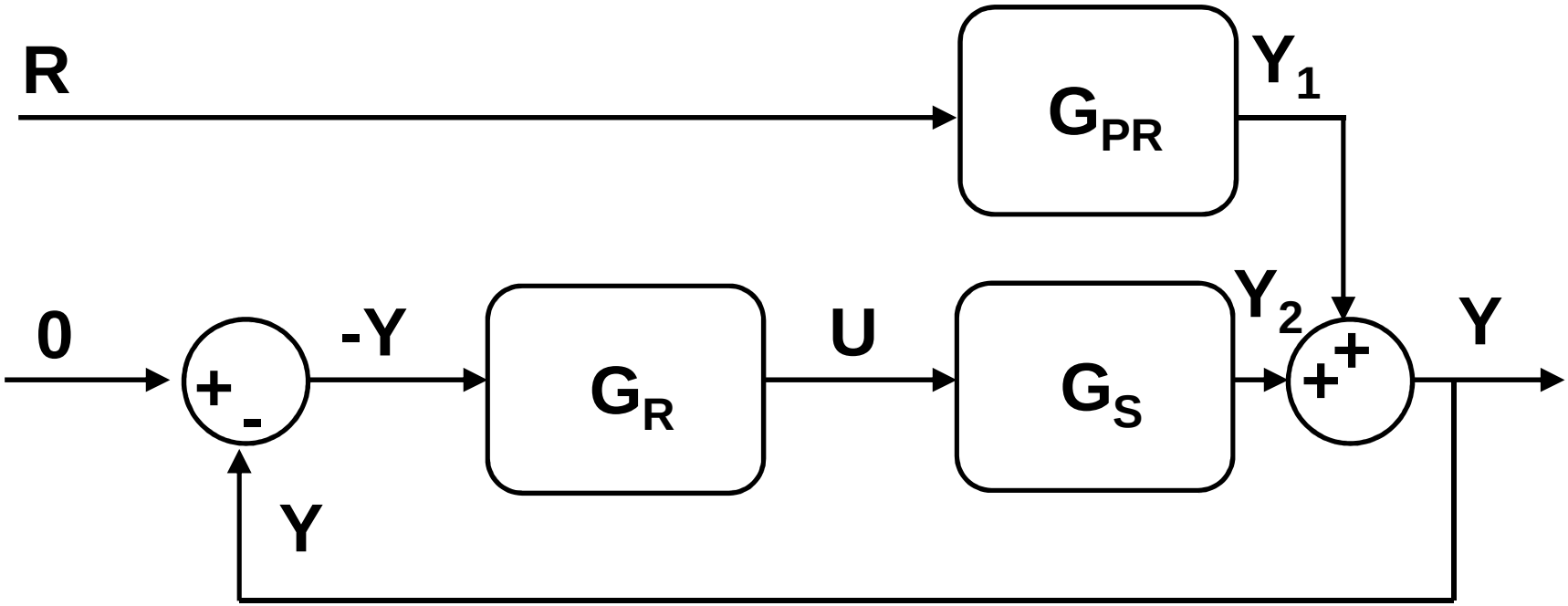
$$Y + G_S G_R Y = G_{PR} R$$

Prenos URO



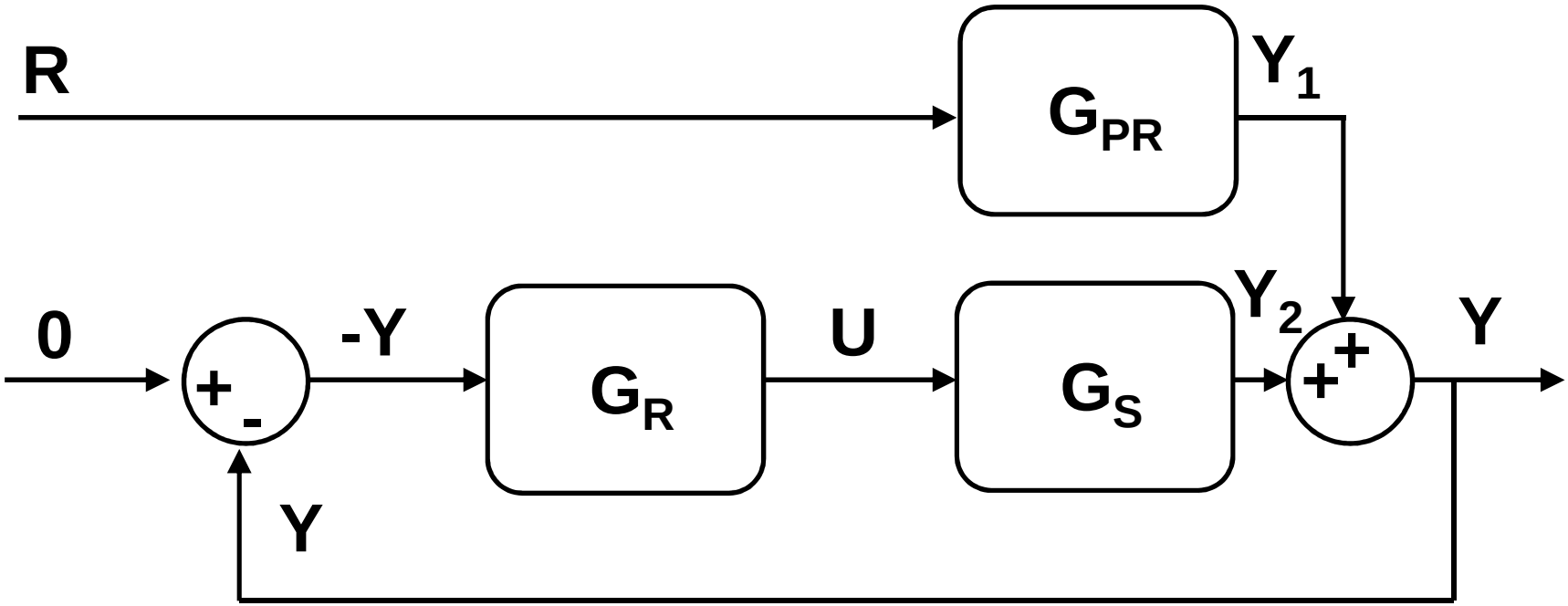
$$Y(1 + G_S G_R) = G_{PR} R$$

Prenos URO



$$Y / R = G_{PR} / (1 + G_S G_R)$$

Prenos URO

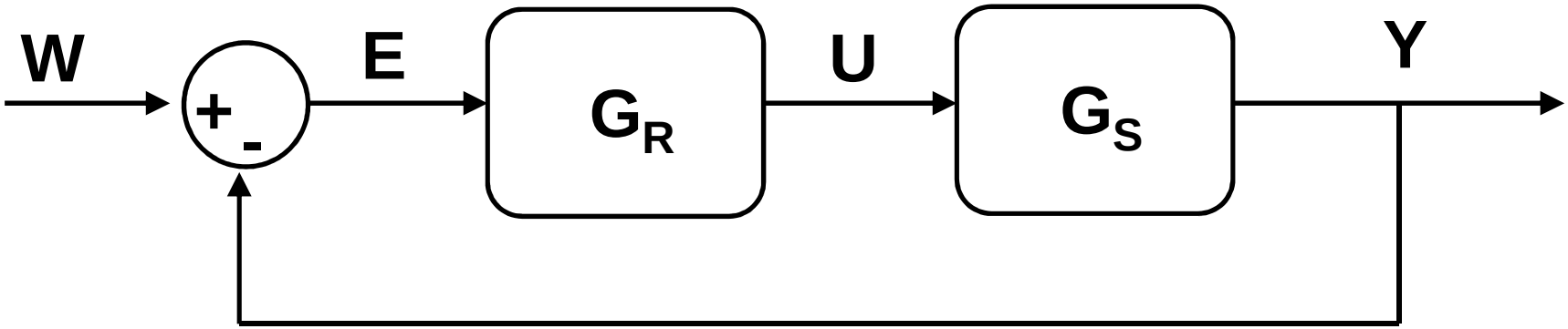


$$G_{YR} = \frac{Y}{R} = \frac{G_{PR}}{1 + G_R G_S}$$

7. Zadanie z LCRP – teoretická časť

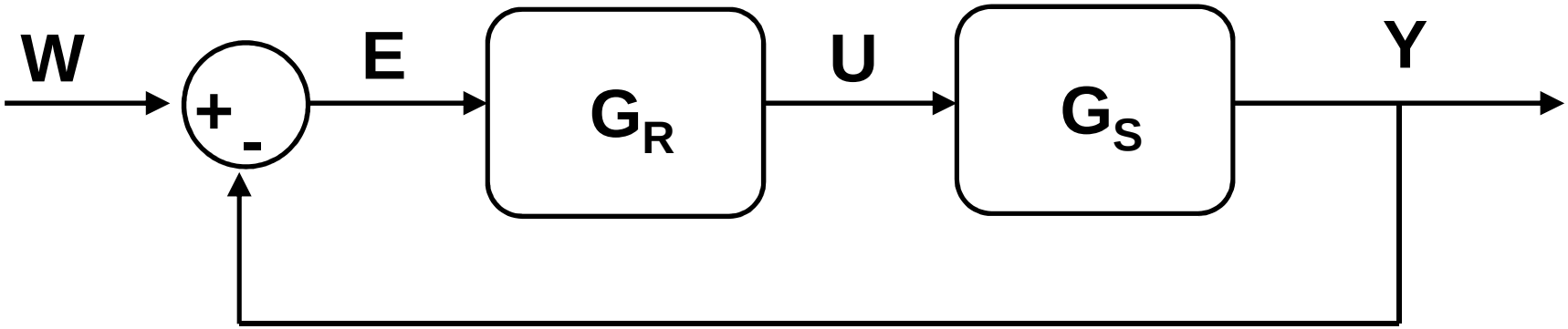
- URO
- prenos URO
- CHR URO
- zákon riadenia
- Routhovo-Schurovo kritérium stability

CHR URO



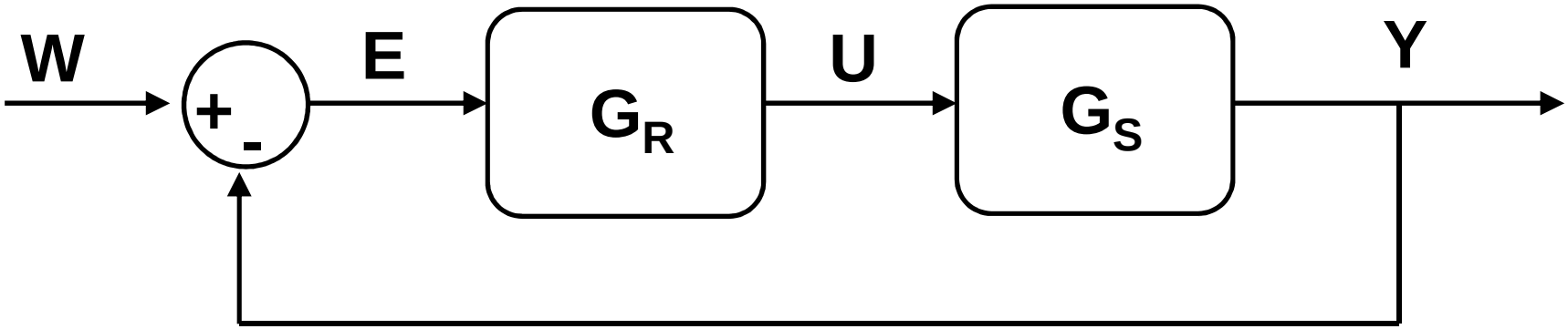
$$G_{URO} = \frac{G_R G_S}{1 + G_R G_S}$$

CHR URO



$$G_{URO} = \frac{G_R G_S}{1 + G_R G_S} \Rightarrow 1 + G_R G_S = 0$$

CHR URO

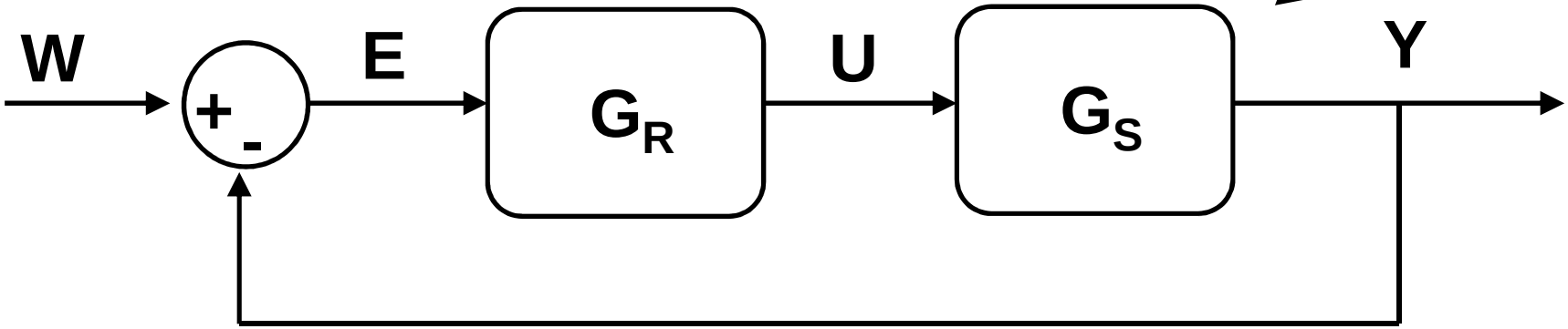


$$G_{URO} = \frac{G_R G_S}{1 + G_R G_S} \Rightarrow 1 + G_R G_S = 0$$

CHR URO

CHR UR

URO je stabilný, ak všetky korene CHR URO majú zápornú reálnu časť

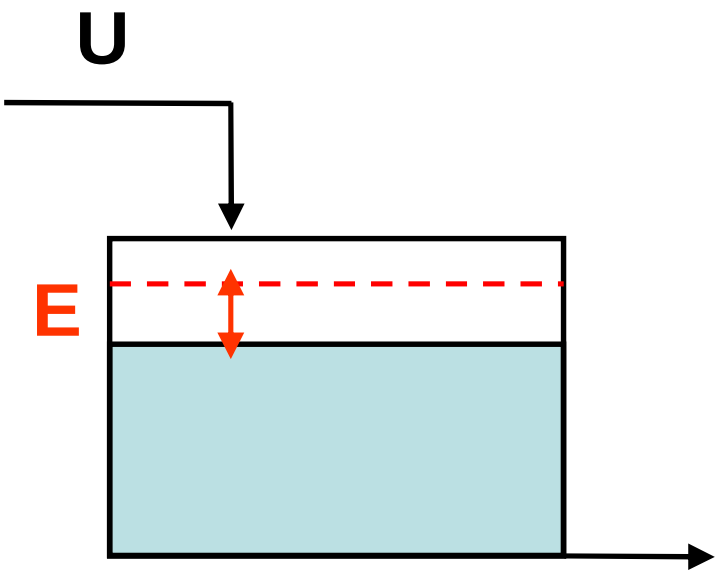


$$G_{URO} = \frac{G_R G_S}{1 + G_R G_S} \Rightarrow 1 + G_R G_S = 0$$

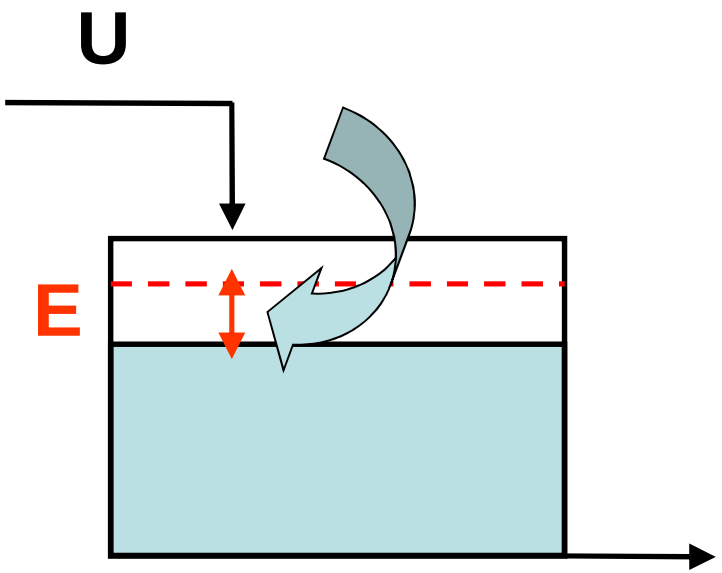
7. Zadanie z LCRP – teoretická časť

- **URO**
- **prenos URO**
- **CHR URO**
- **zákon riadenia**
- **Routhovo-Schurovo kritérium stability**

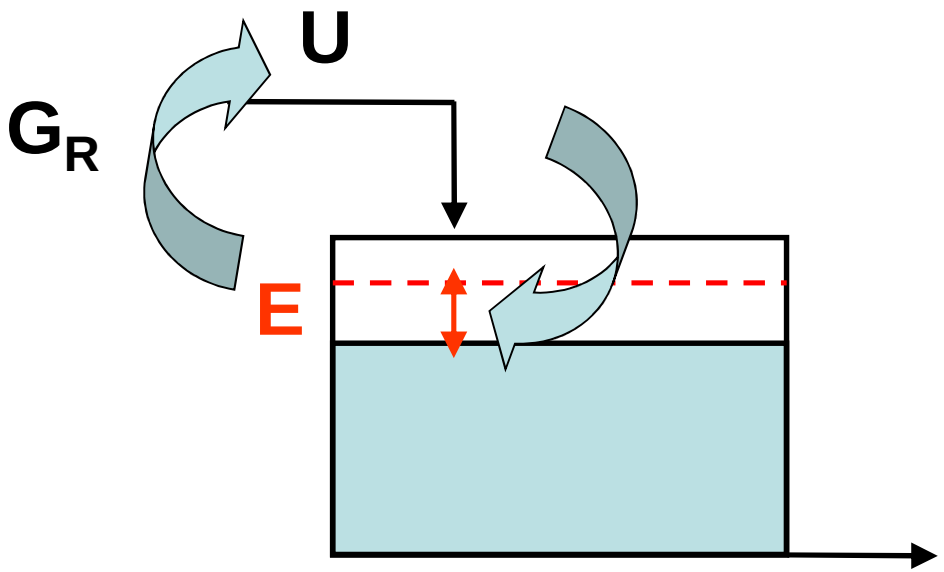
Zákon riadenia



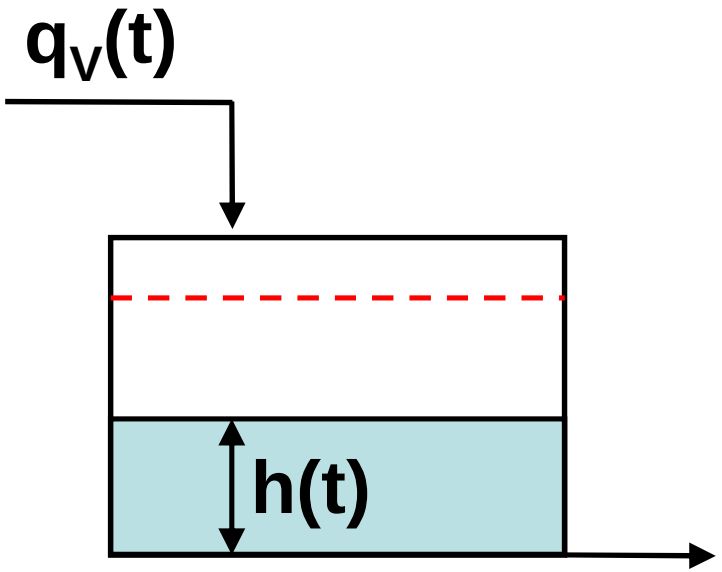
Zákon riadenia



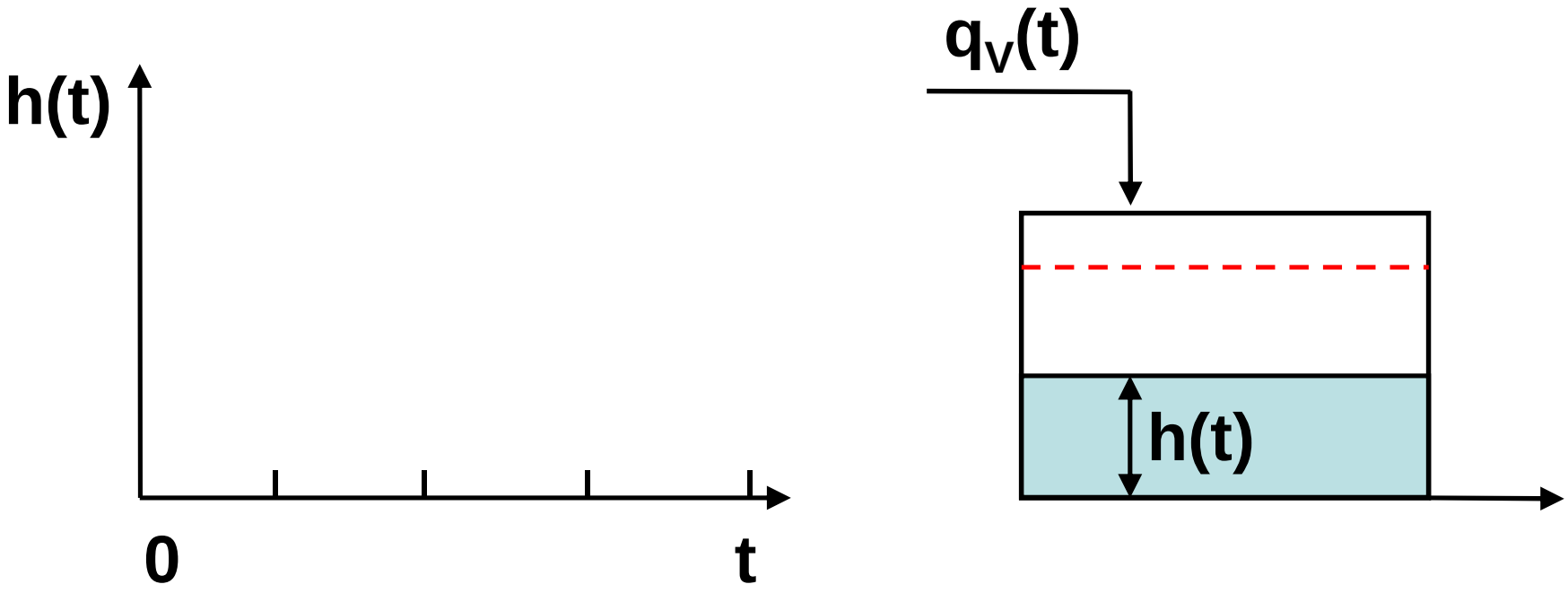
Zákon riadenia



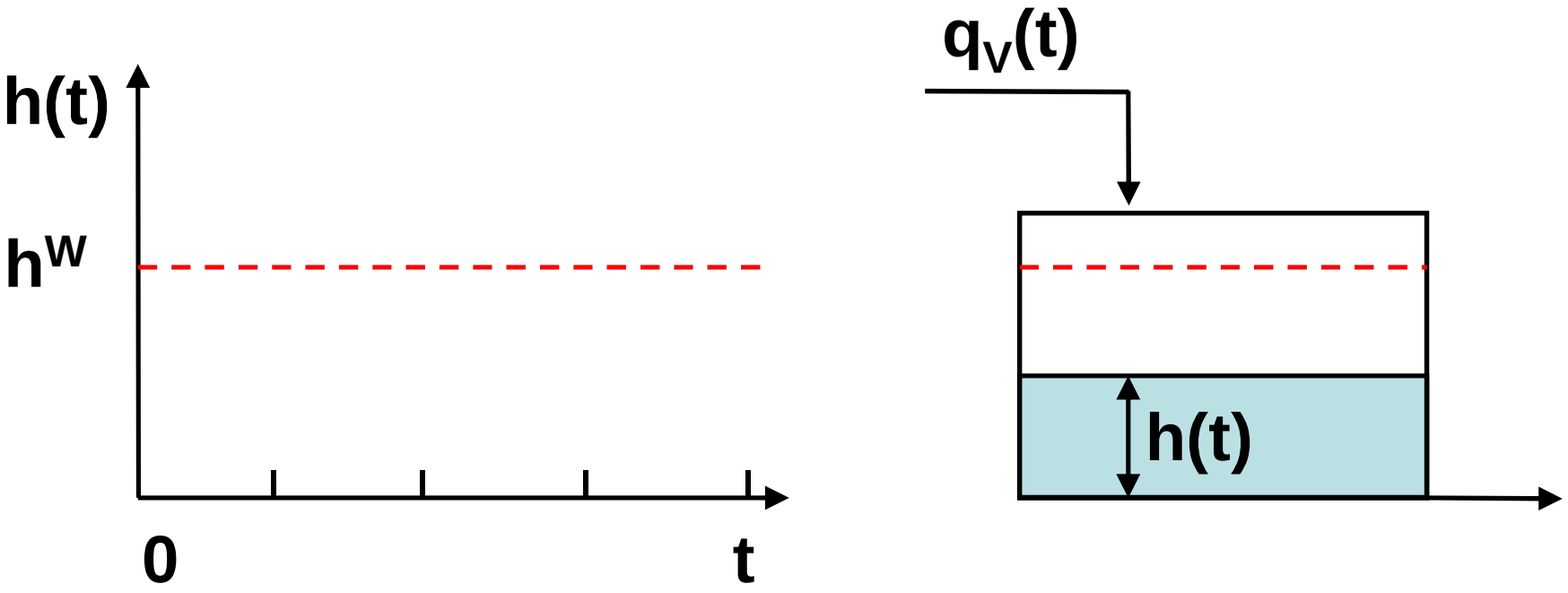
Zákon riadenia



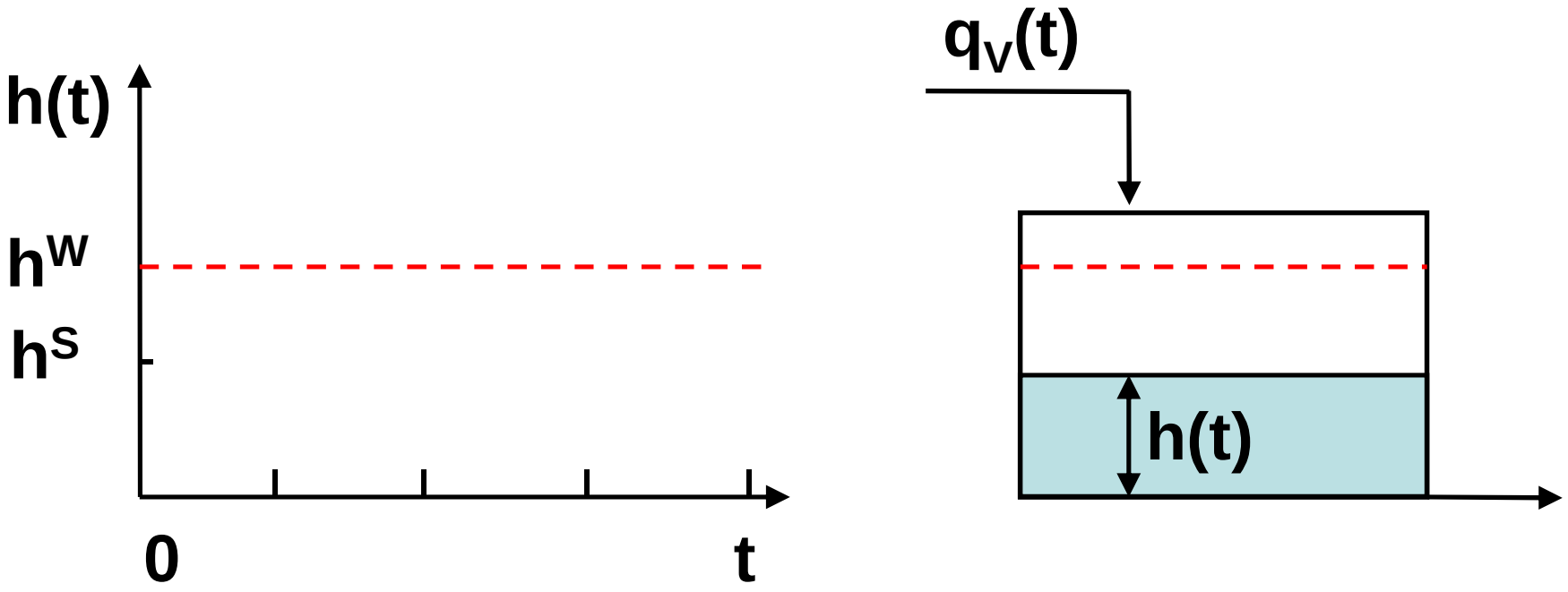
Zákon riadenia



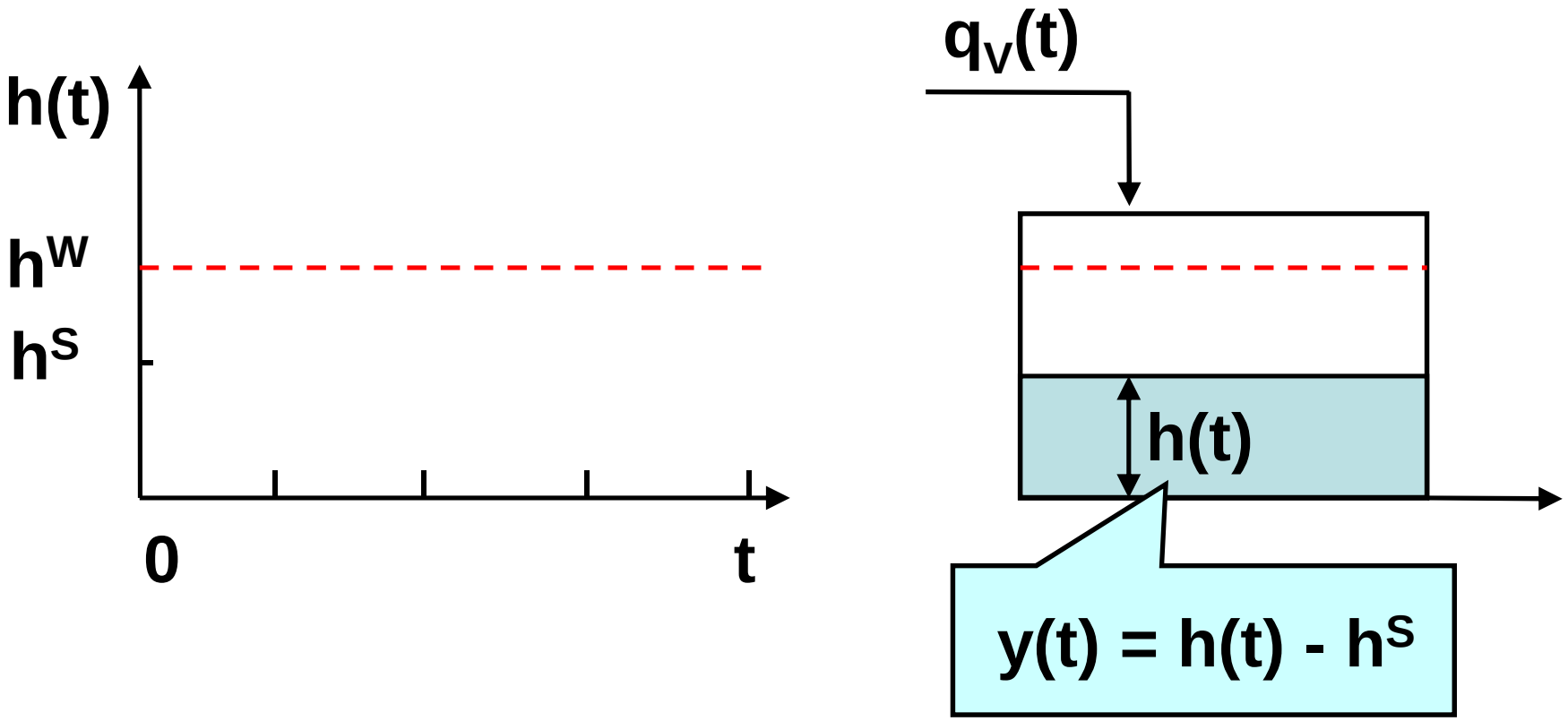
Zákon riadenia



Zákon riadenia



Zákon riadenia



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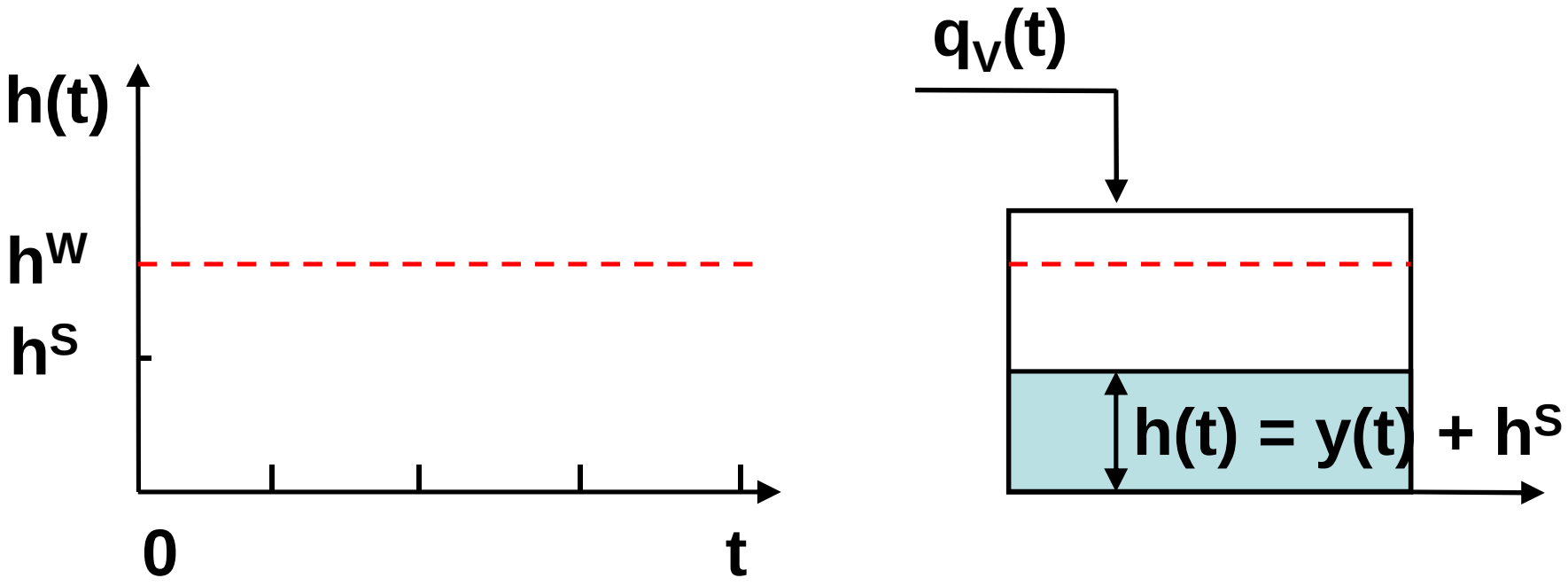

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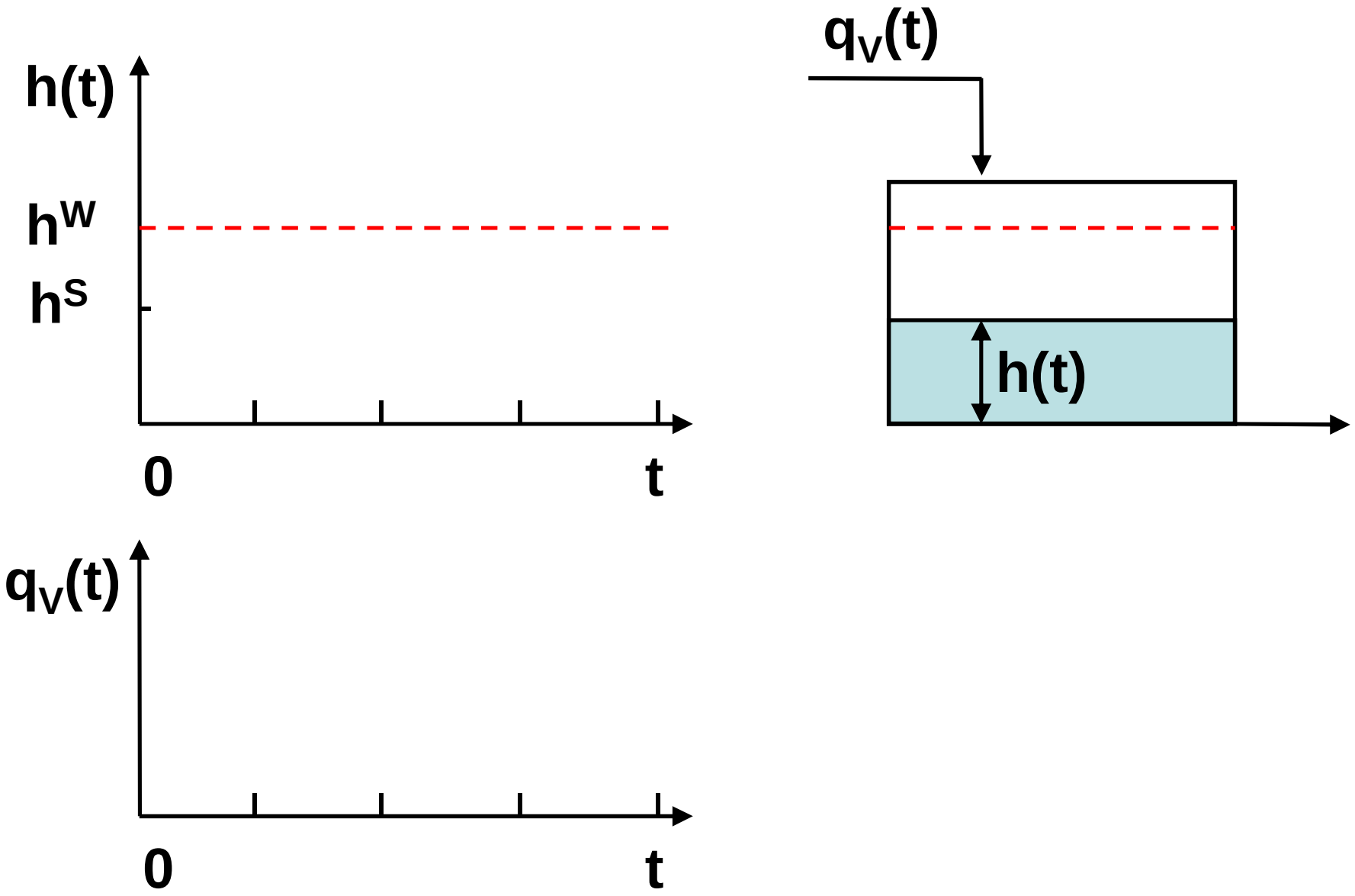

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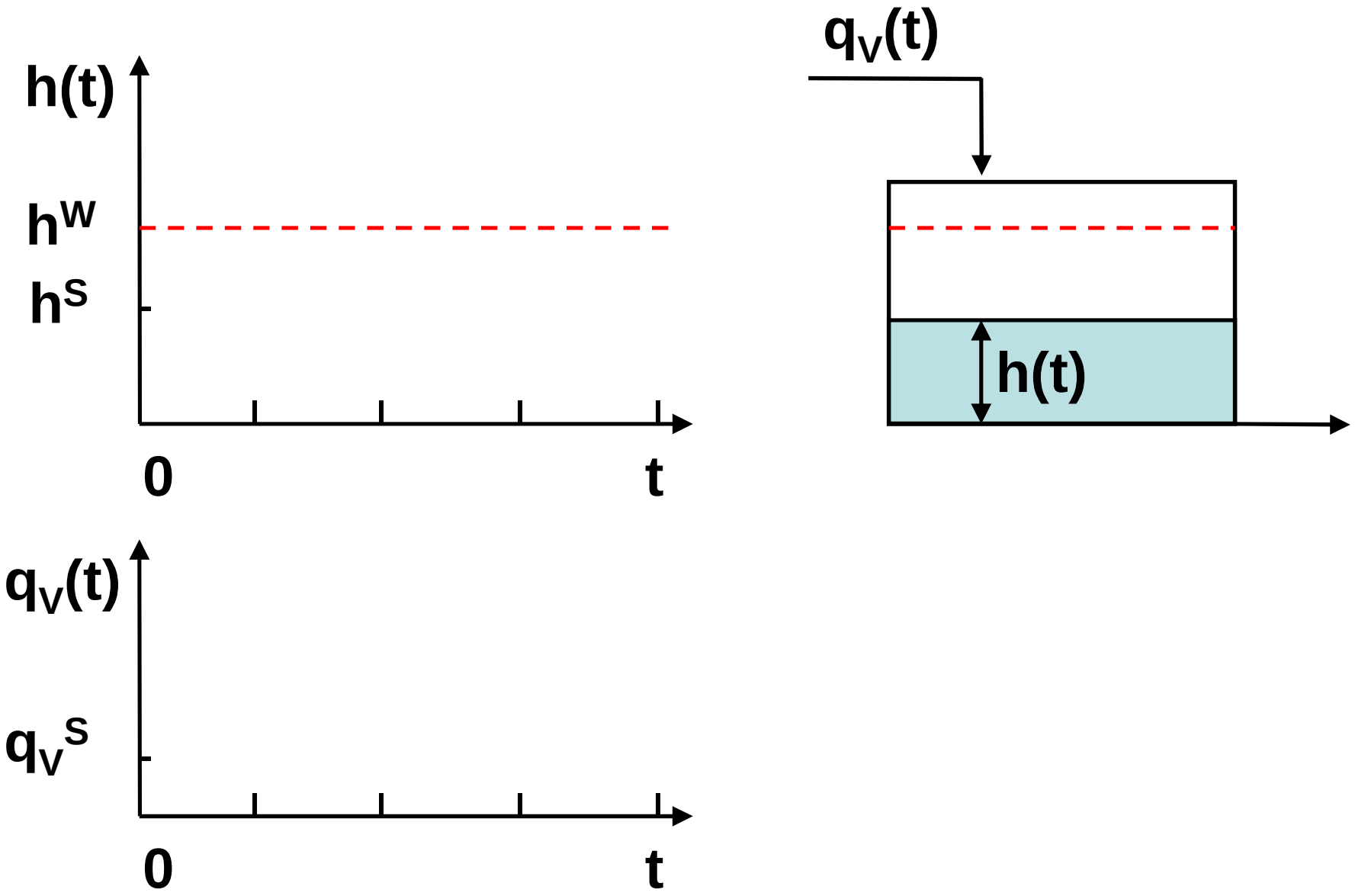

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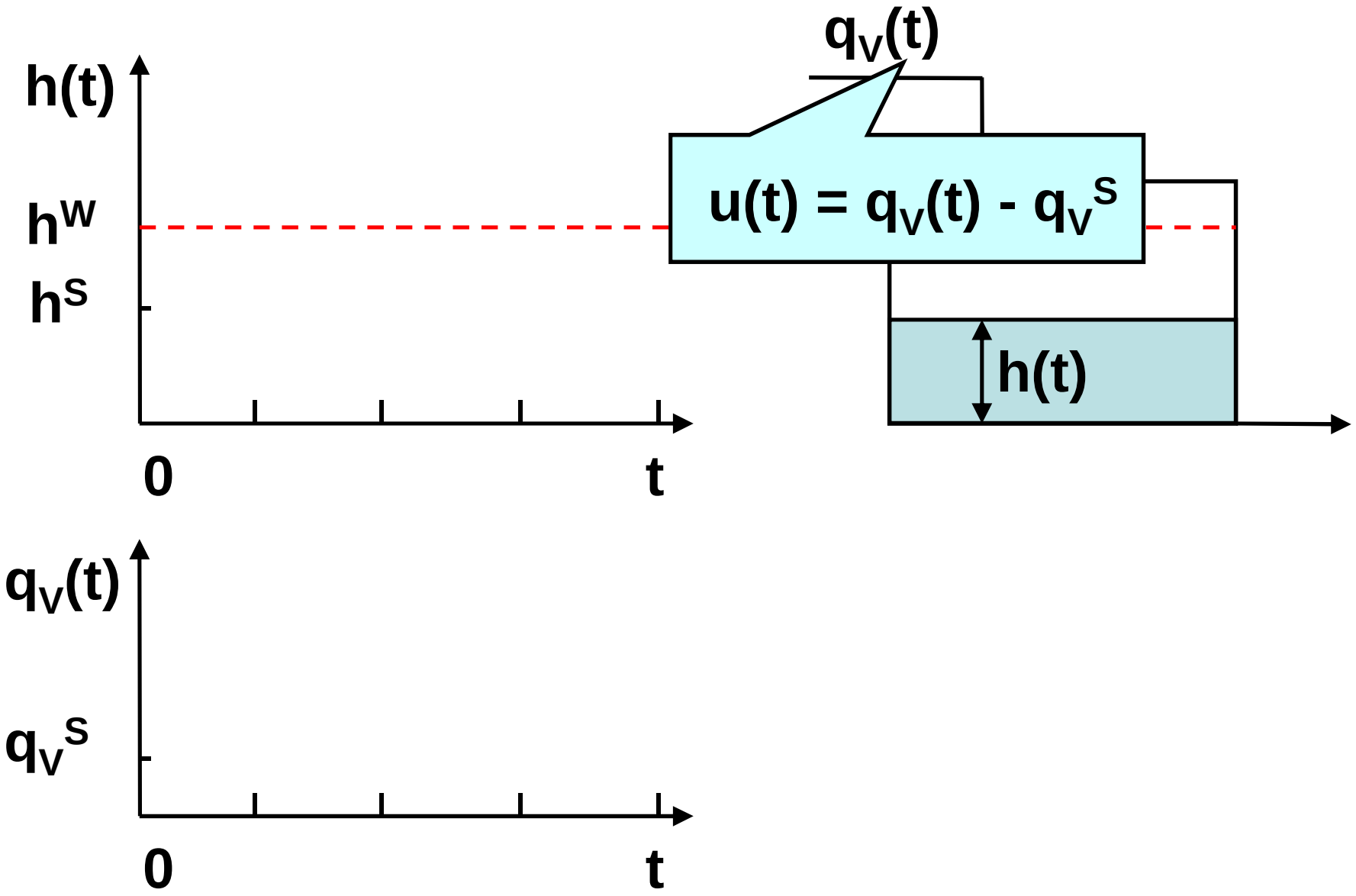

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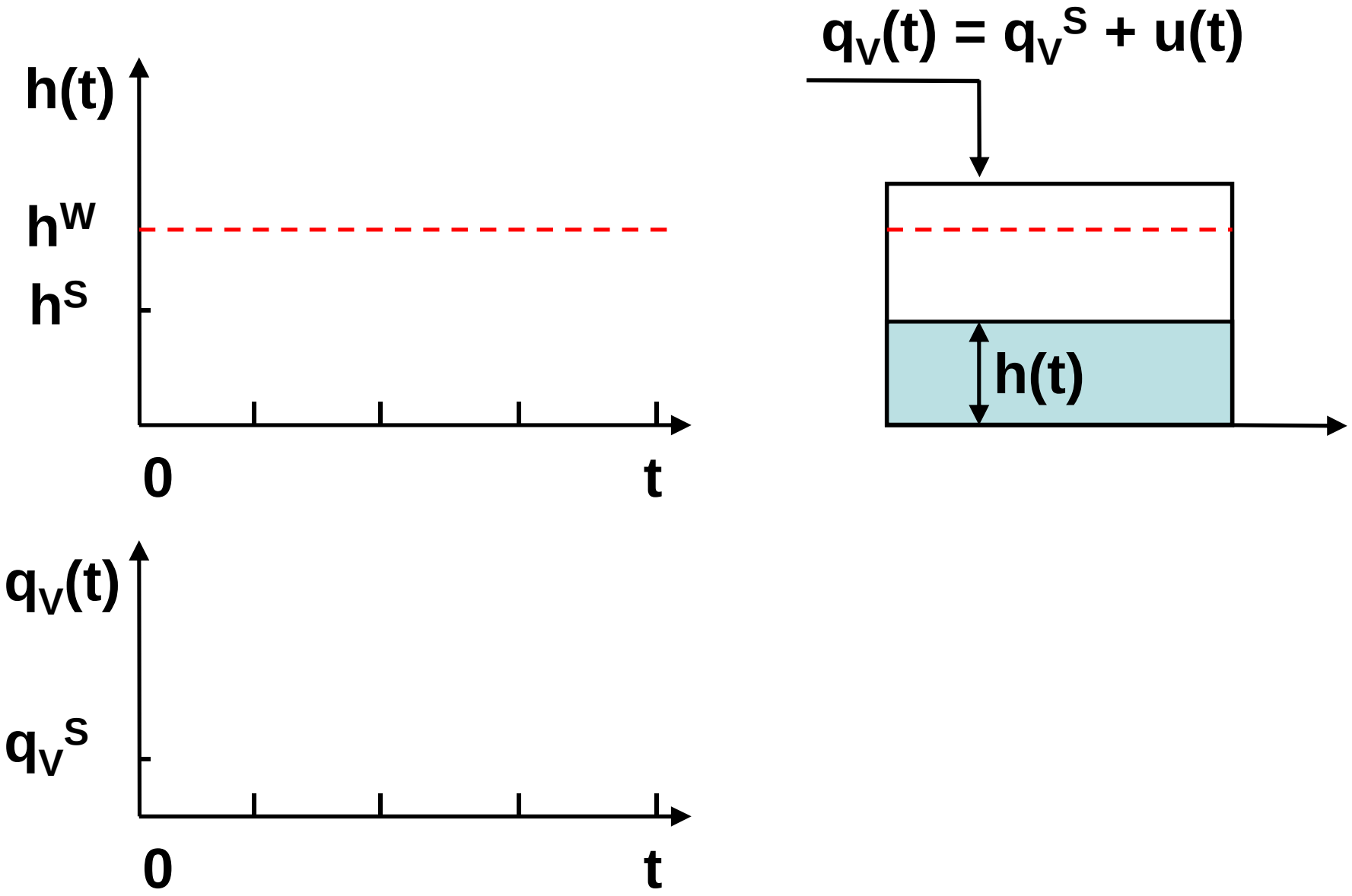

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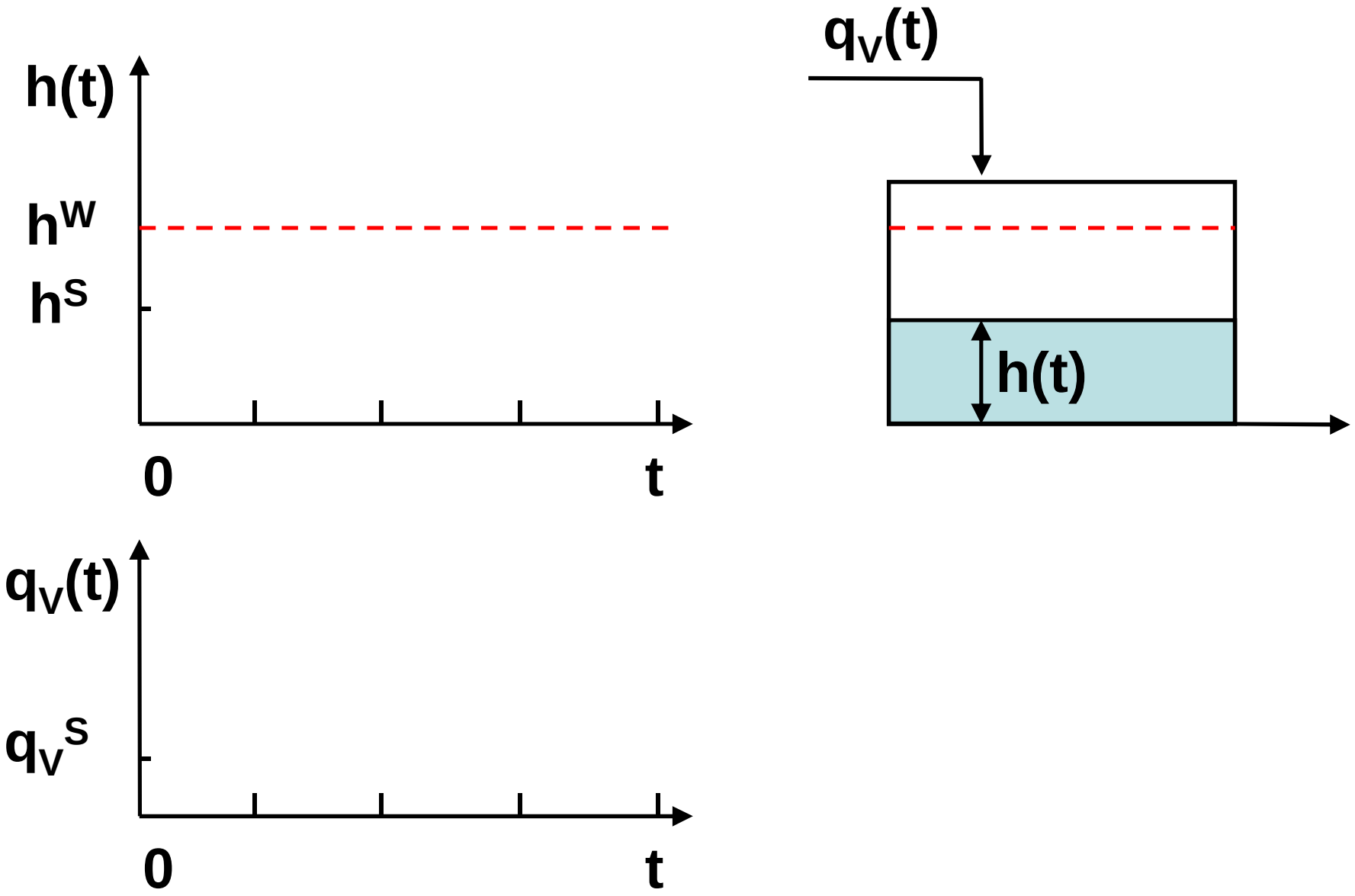

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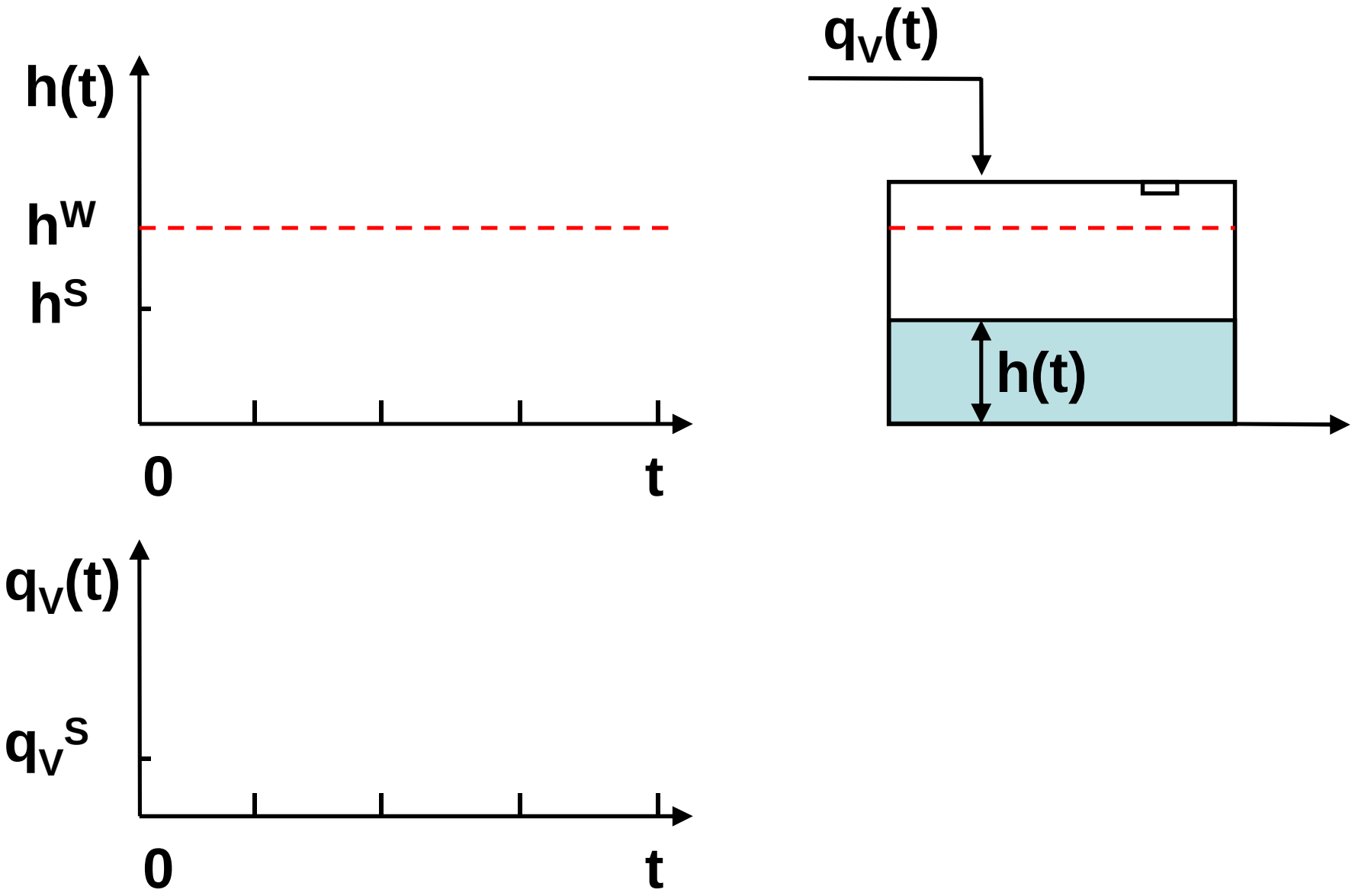

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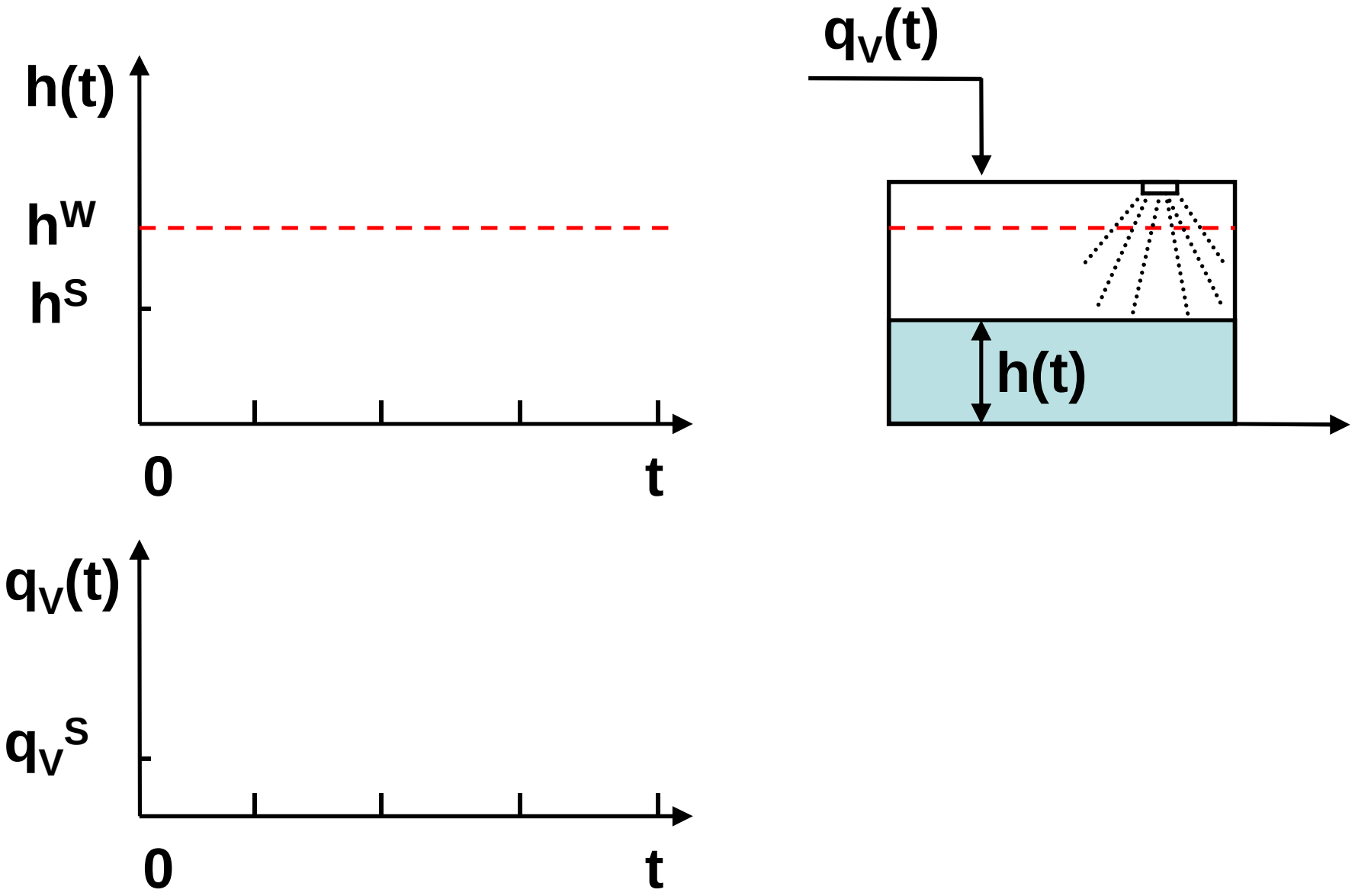

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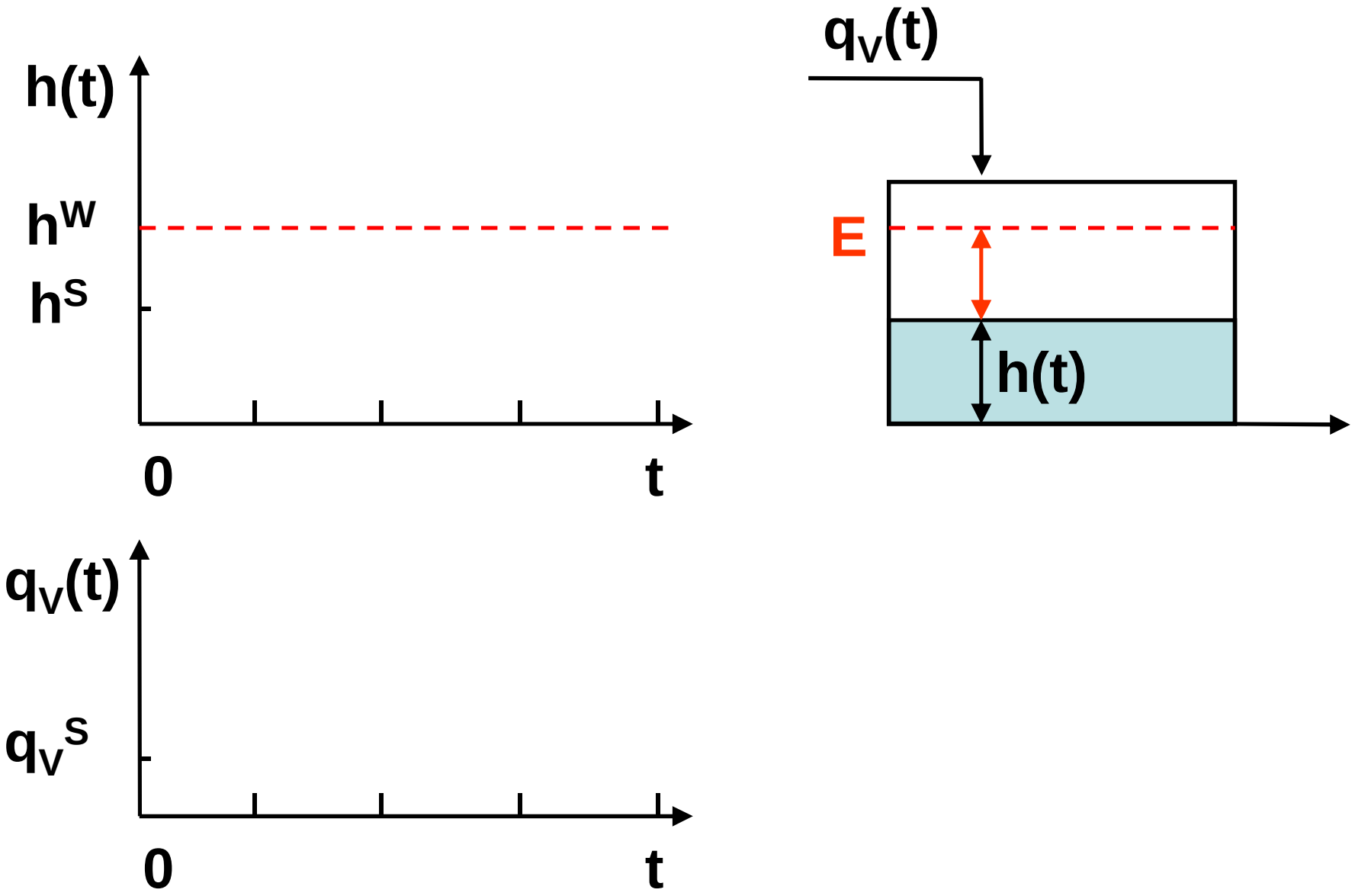

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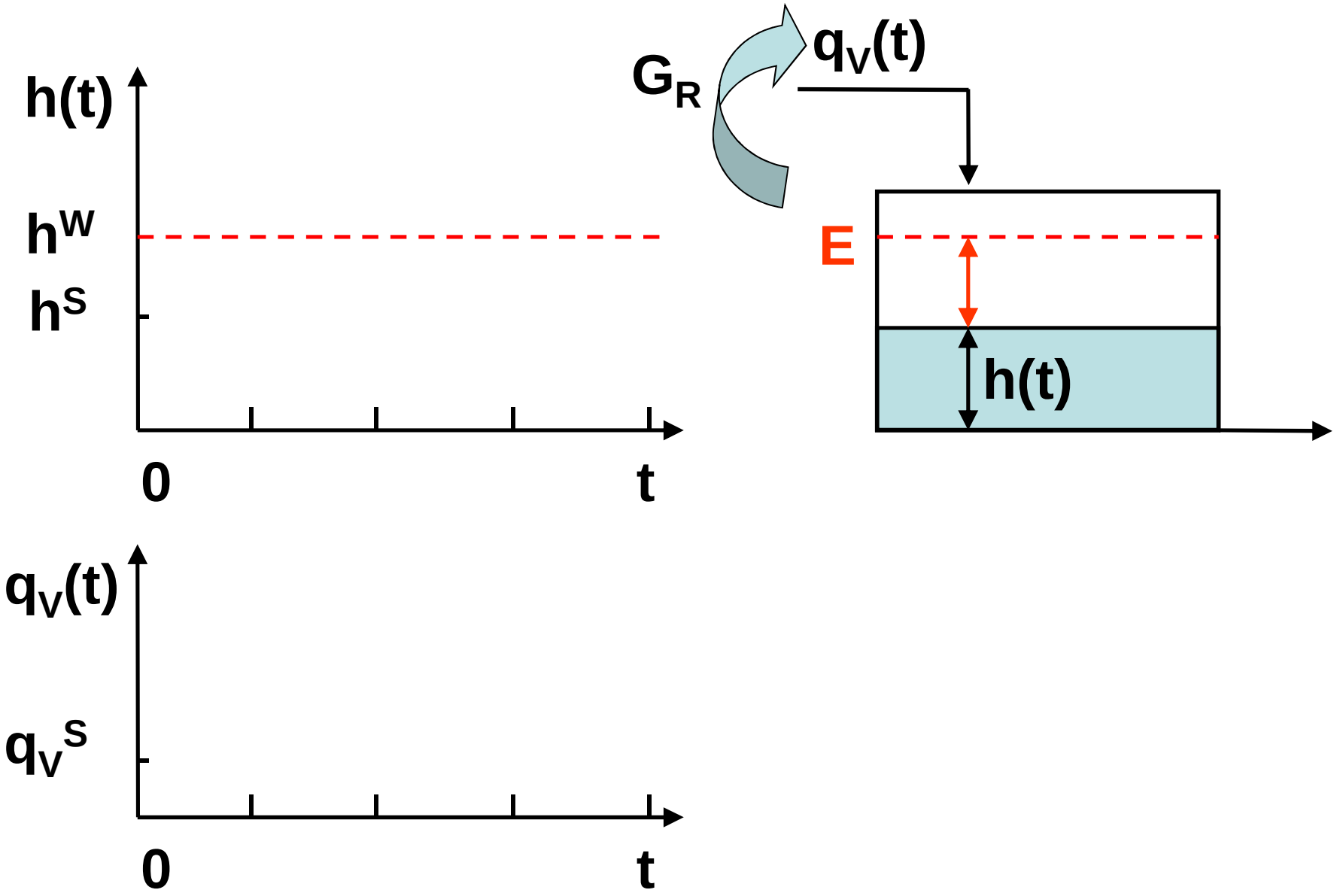

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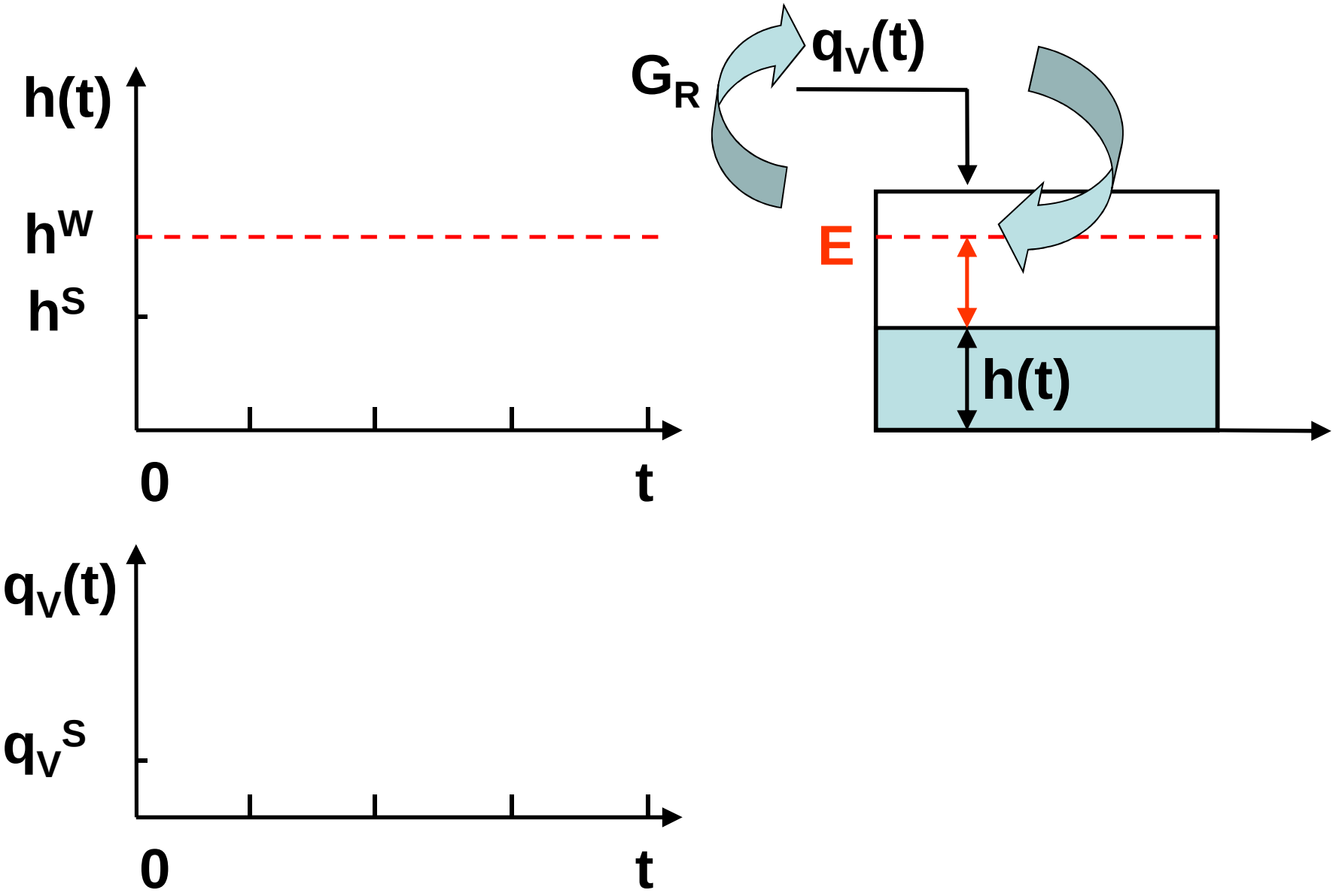

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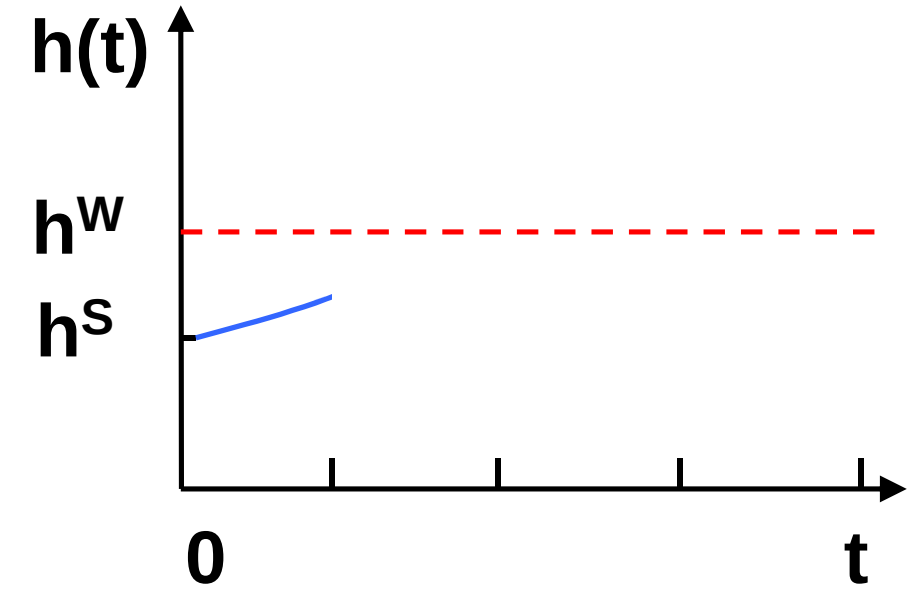

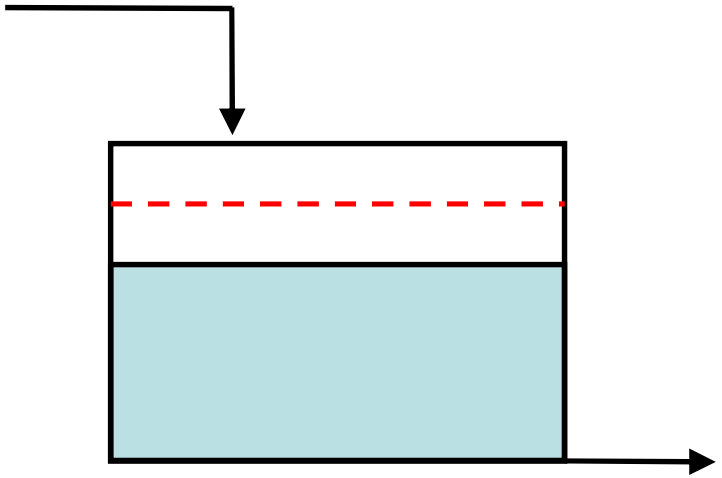

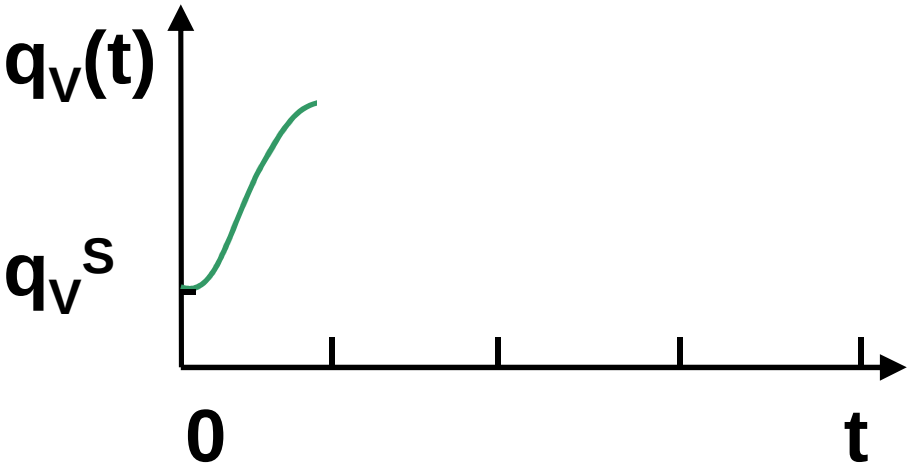

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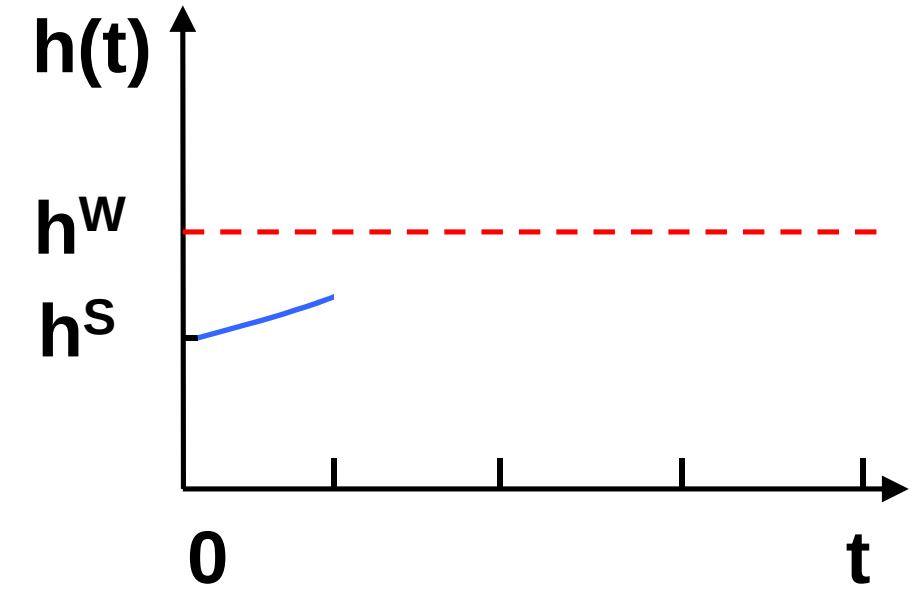

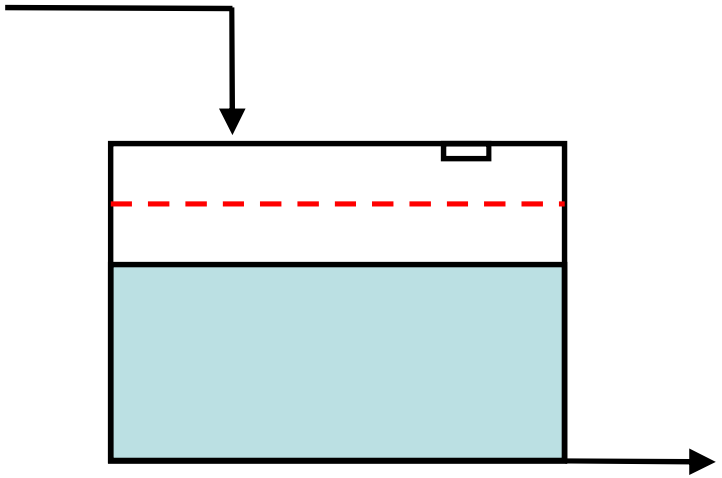

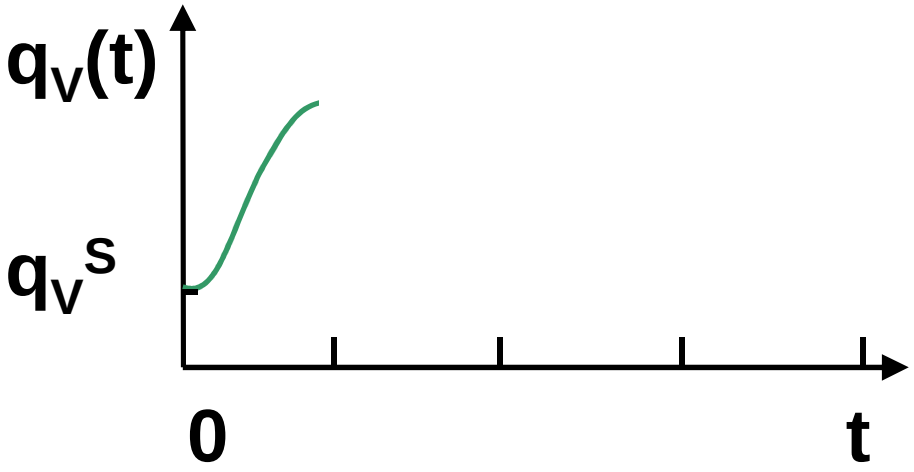

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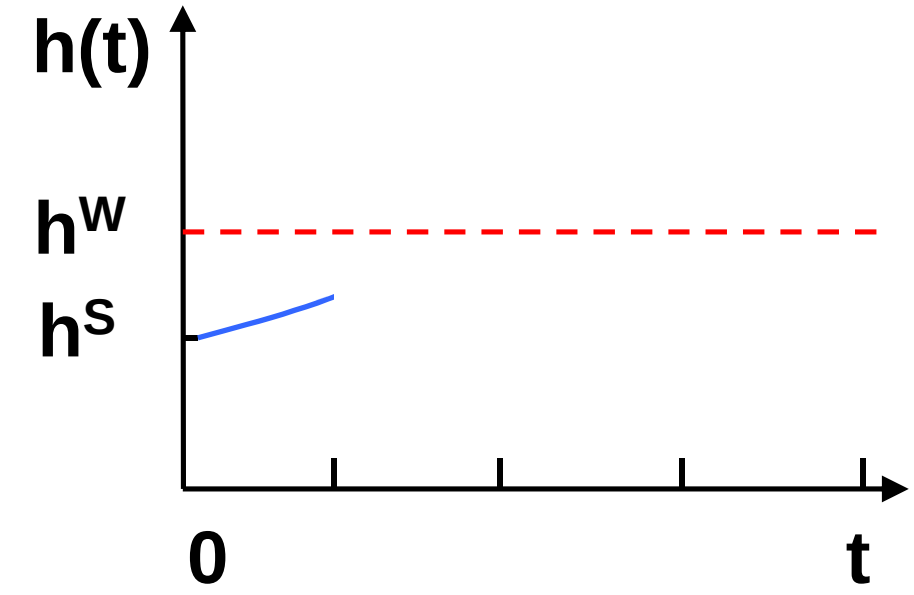

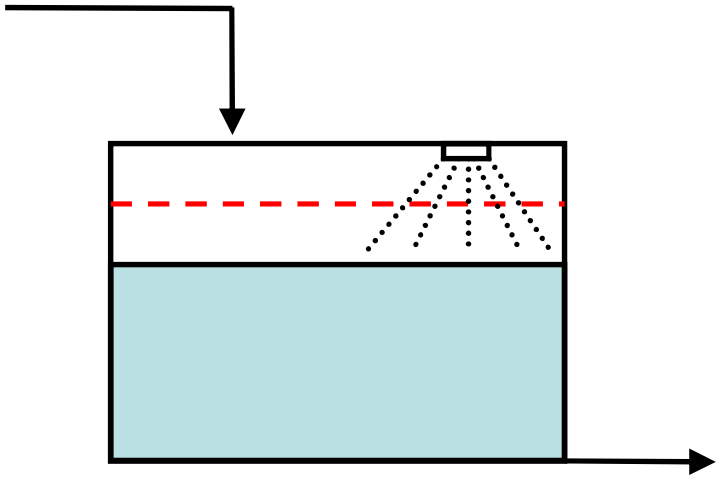

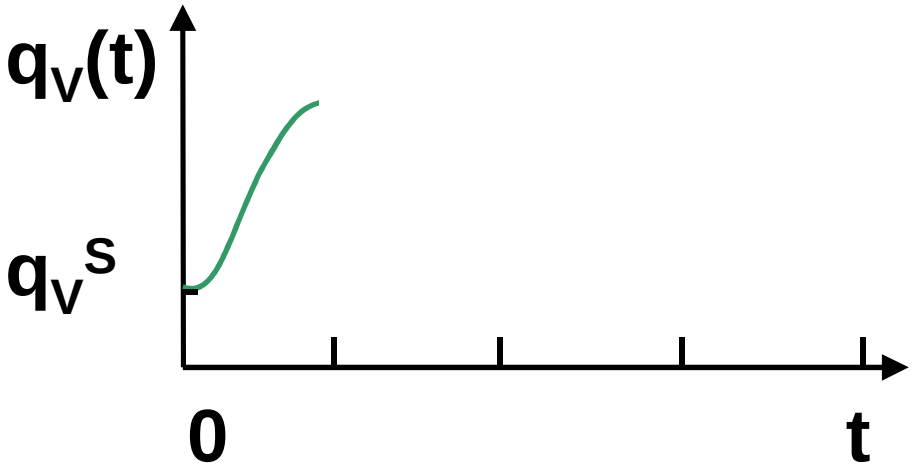

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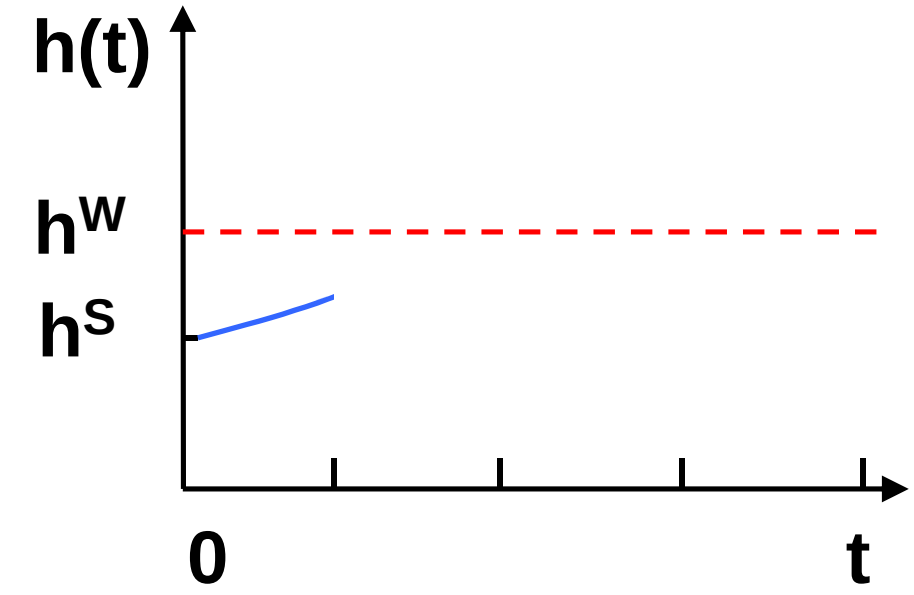

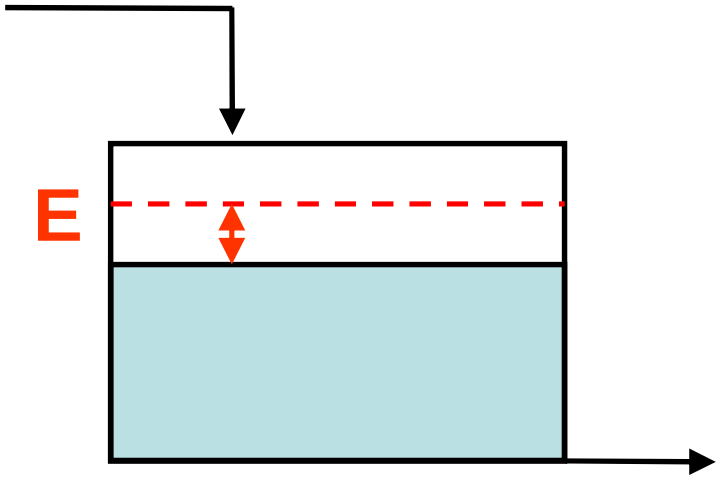

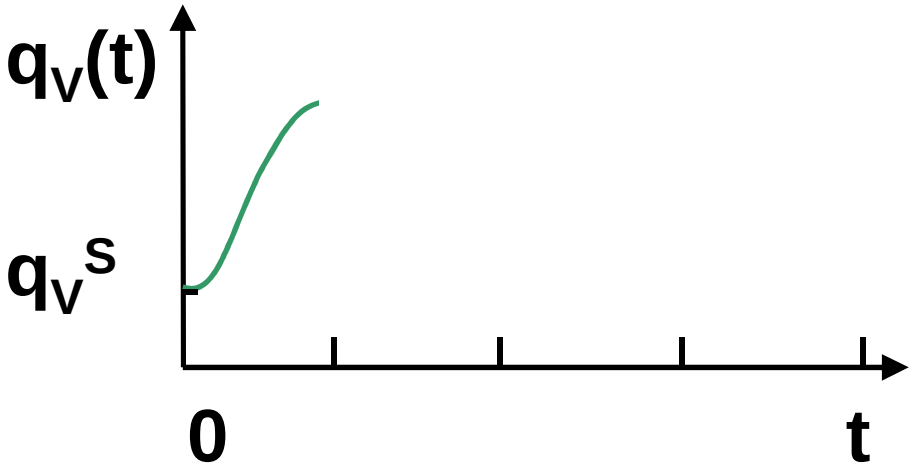

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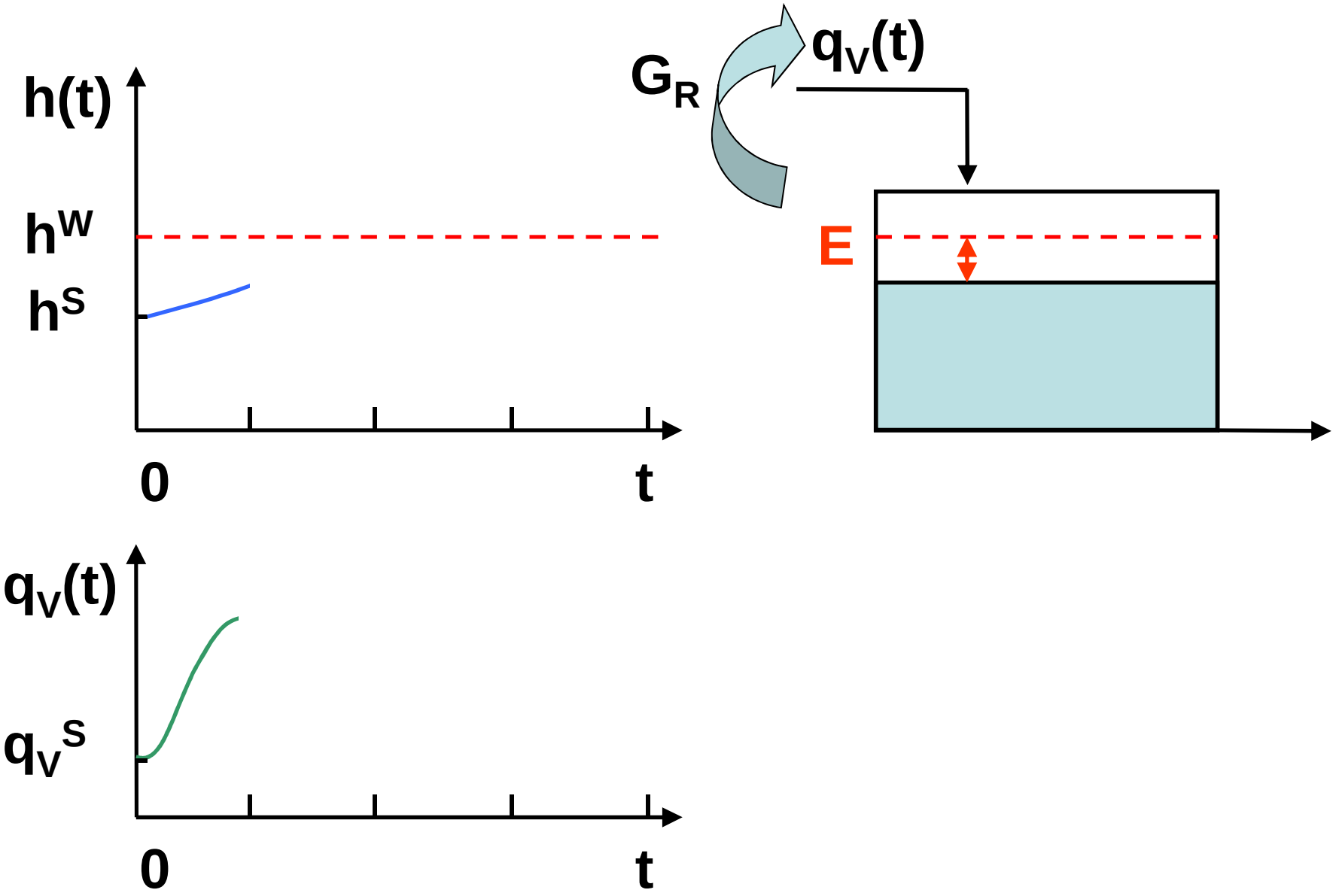

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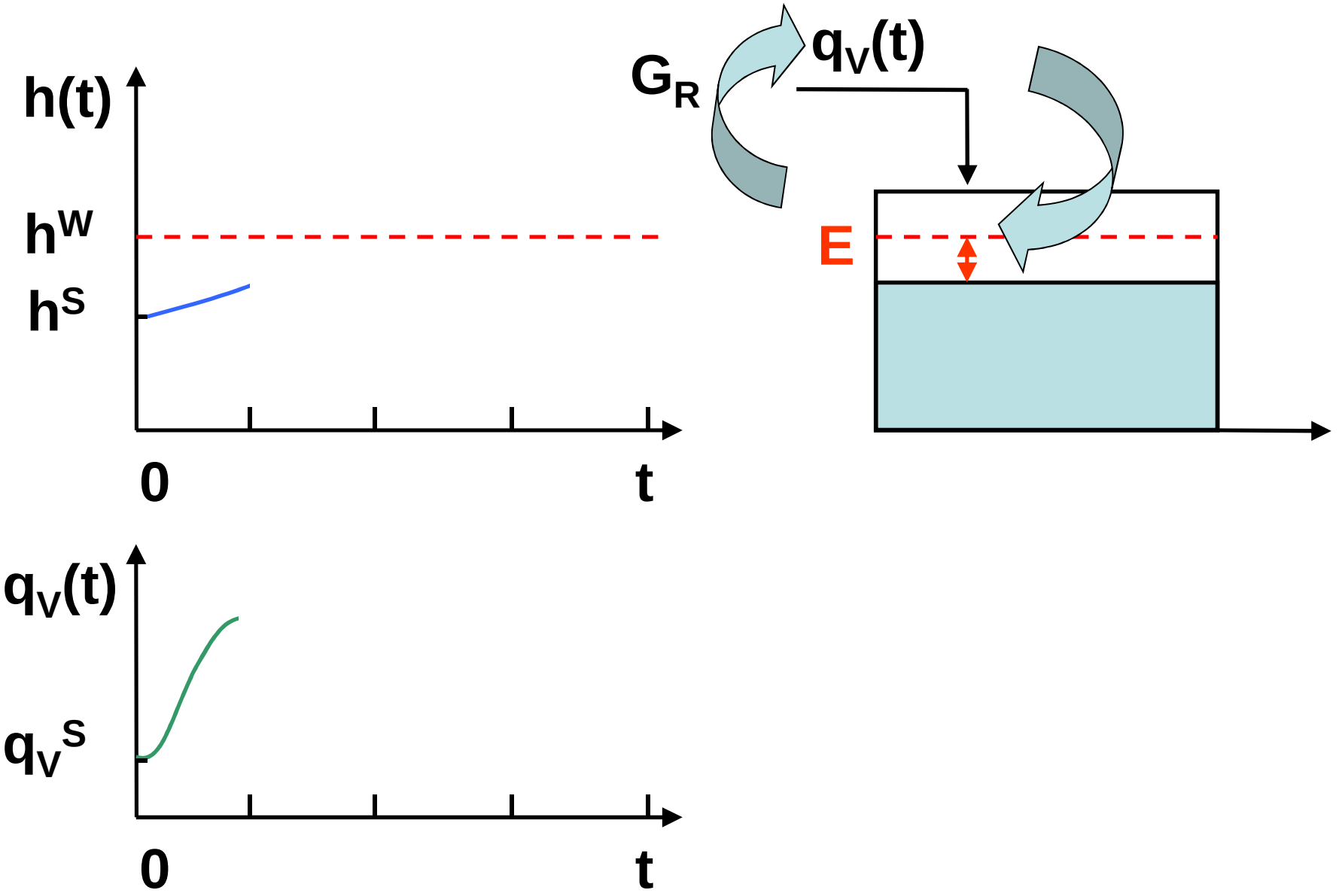

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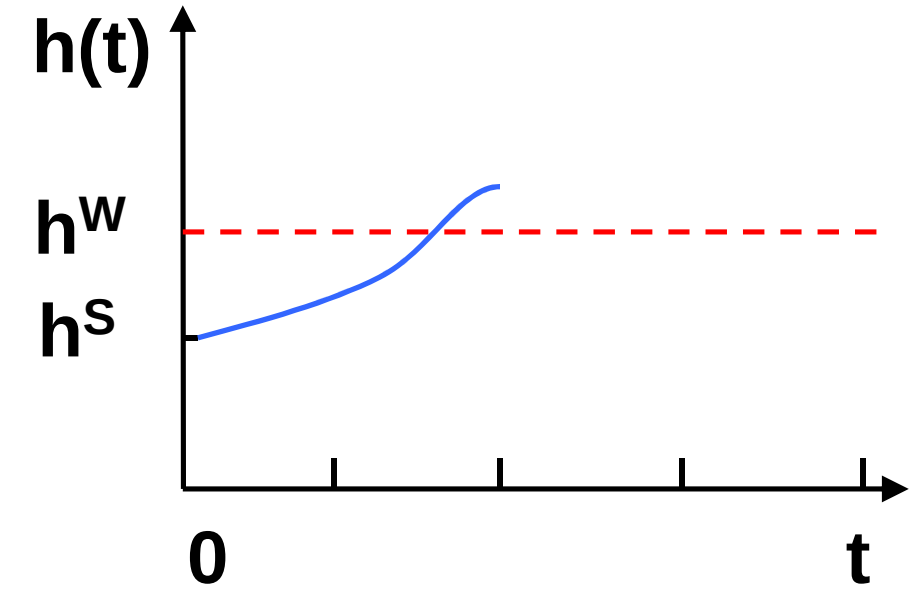

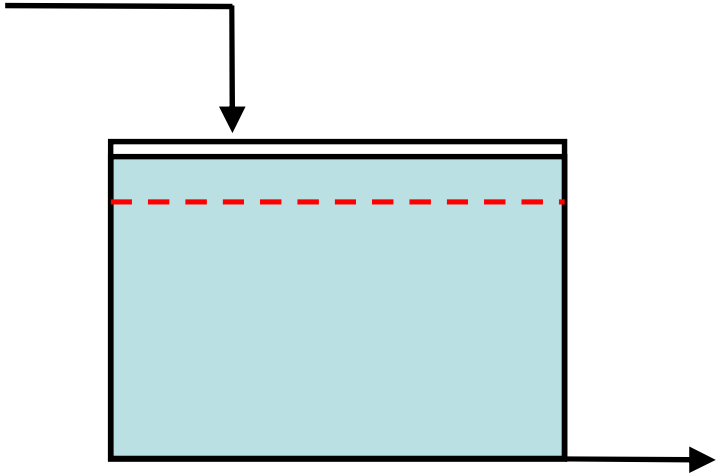

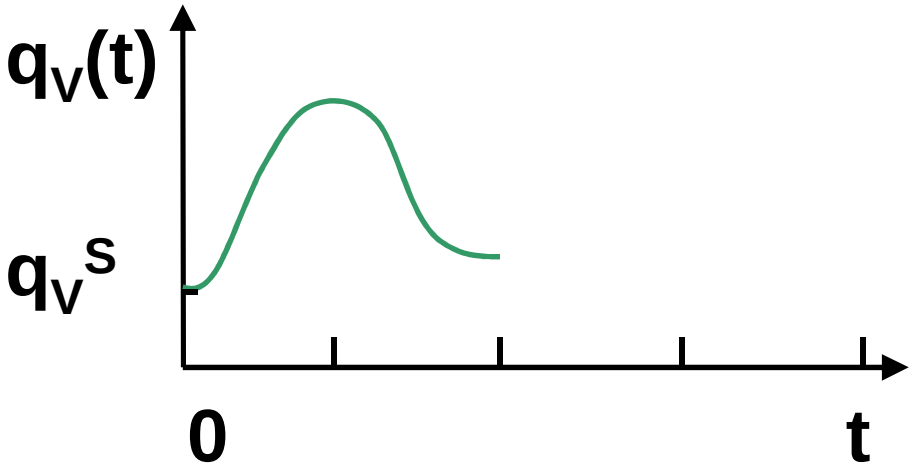

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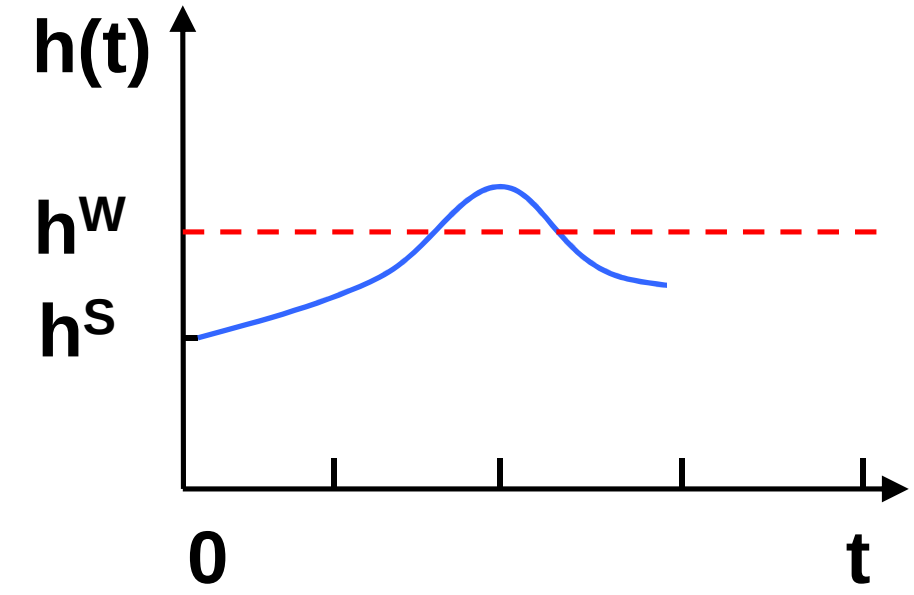

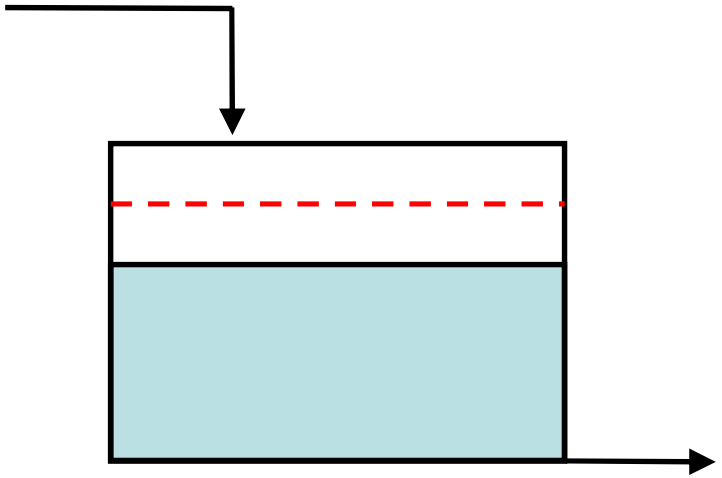

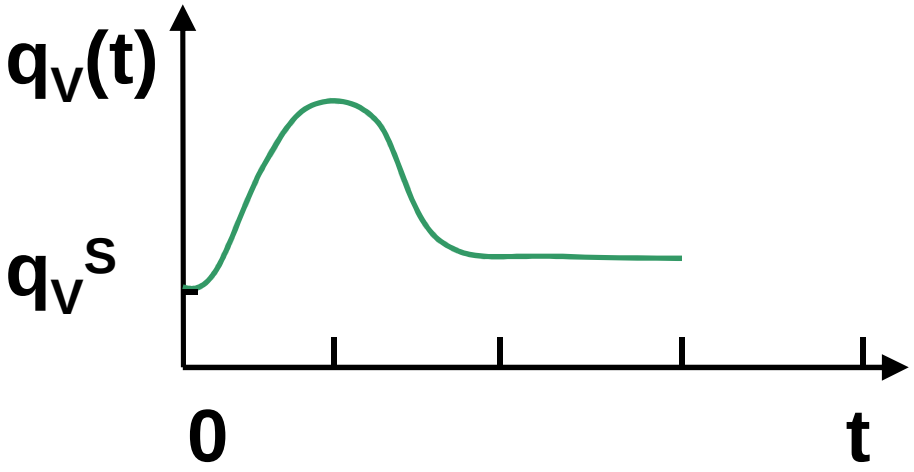

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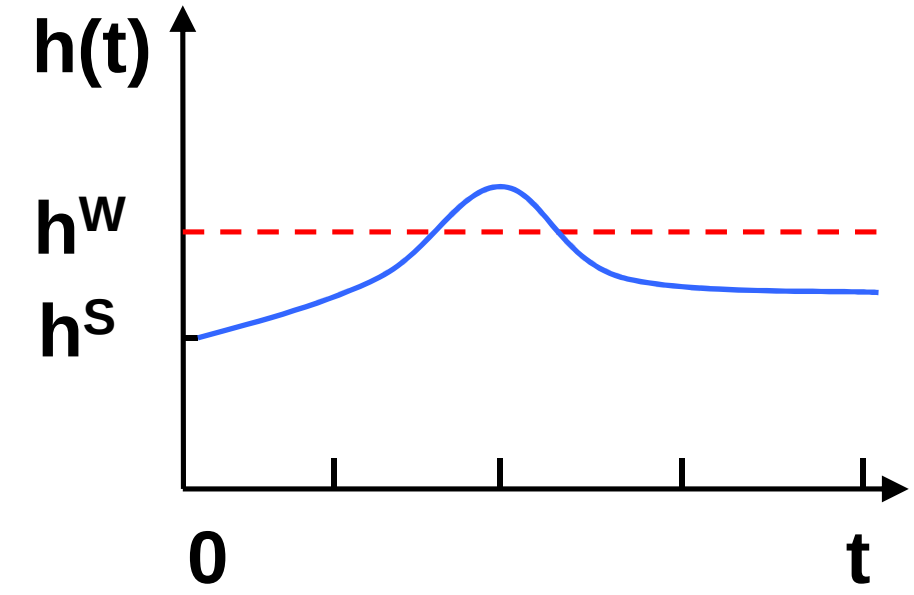

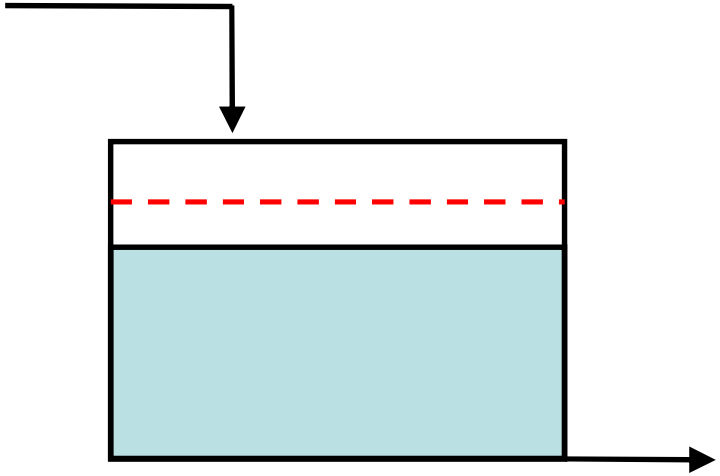

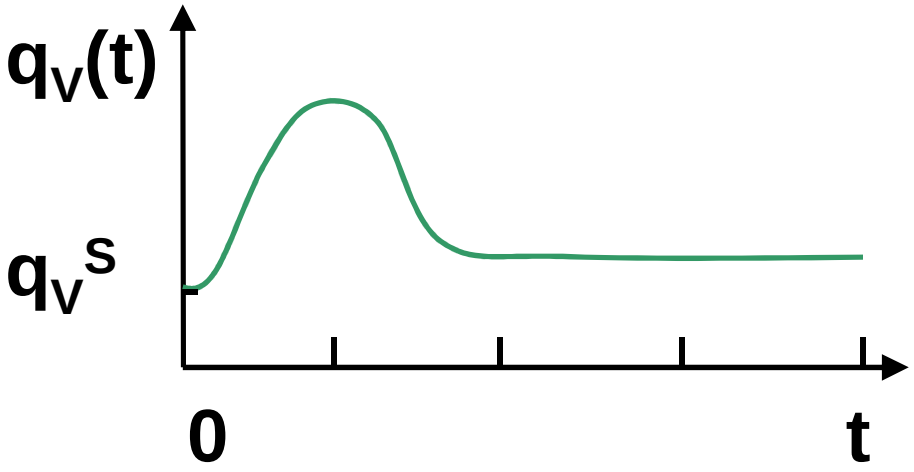

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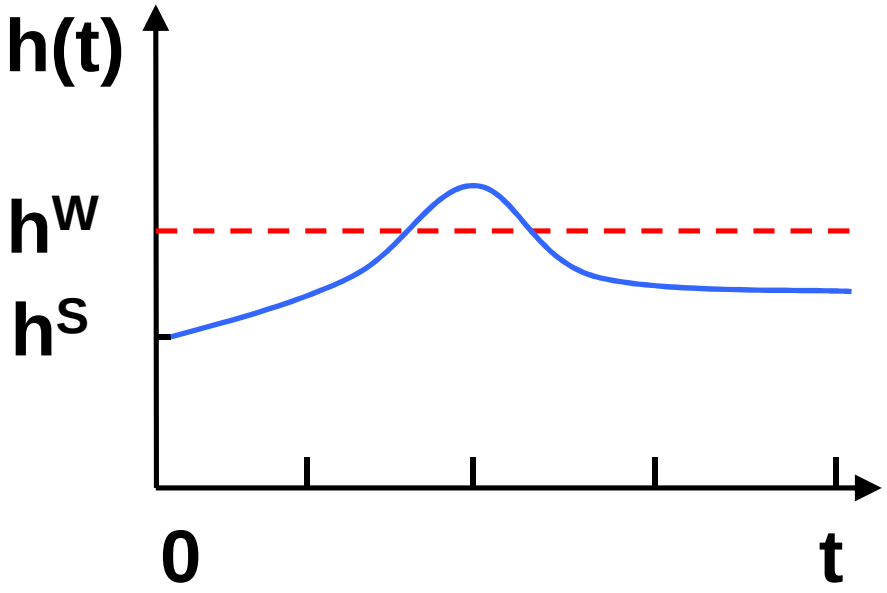

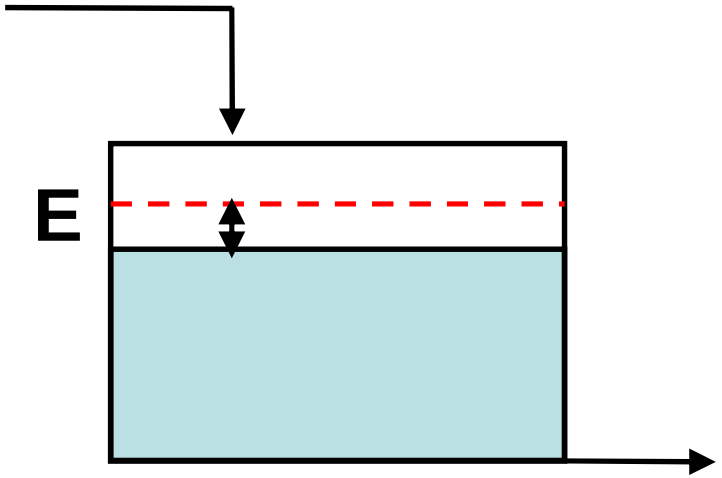

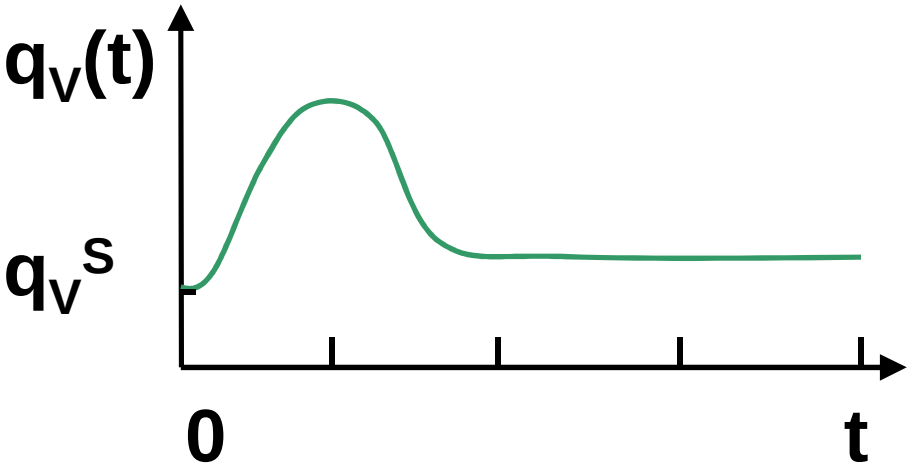

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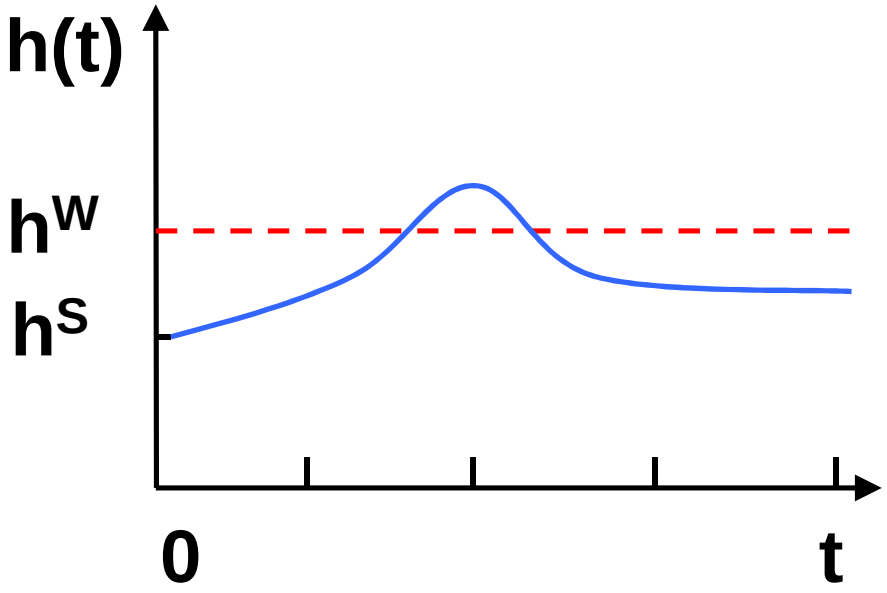
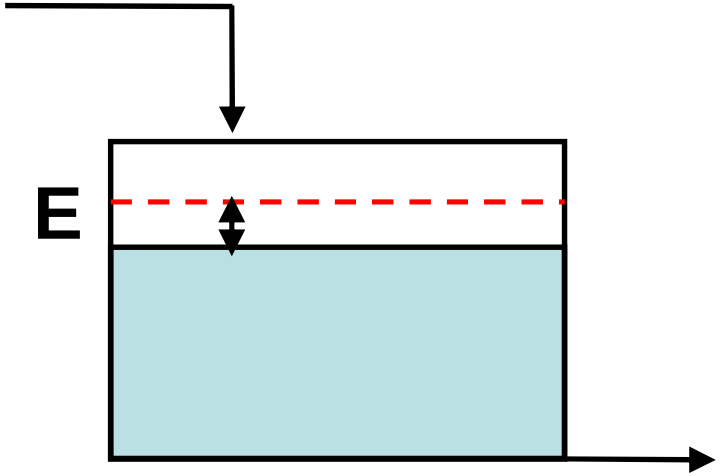
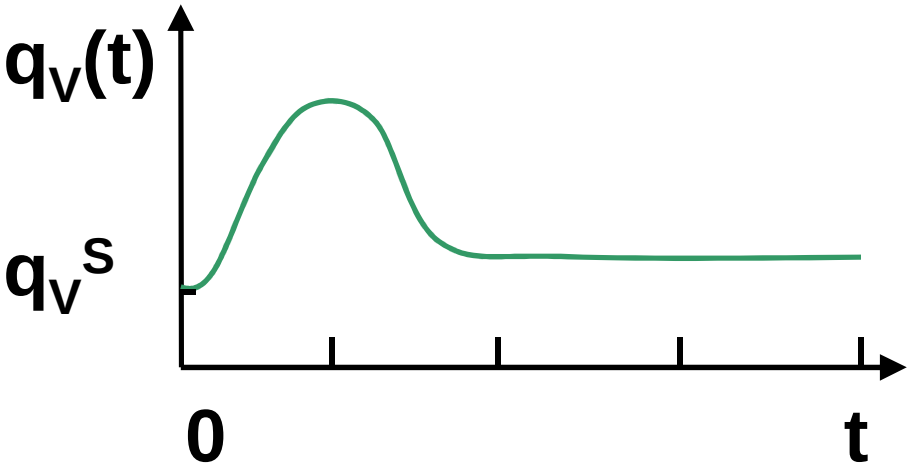
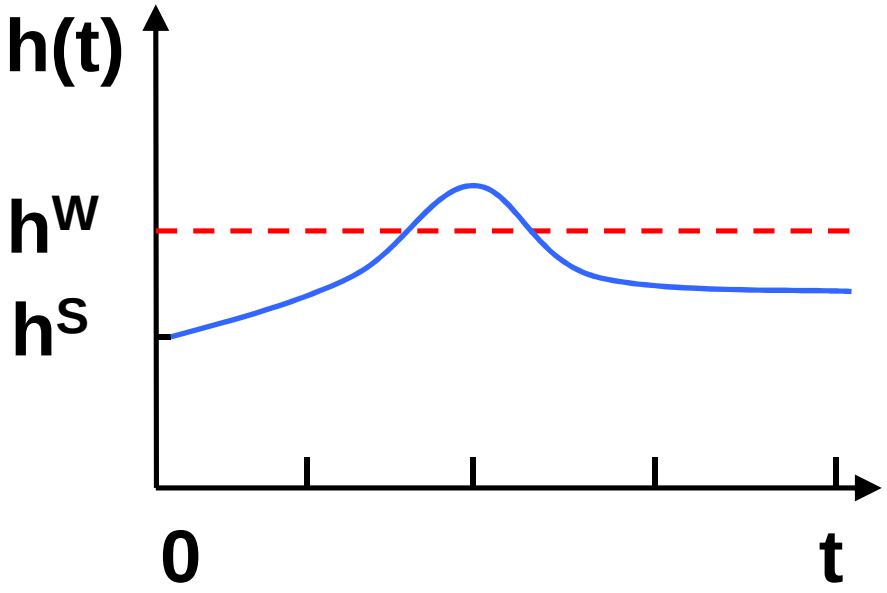


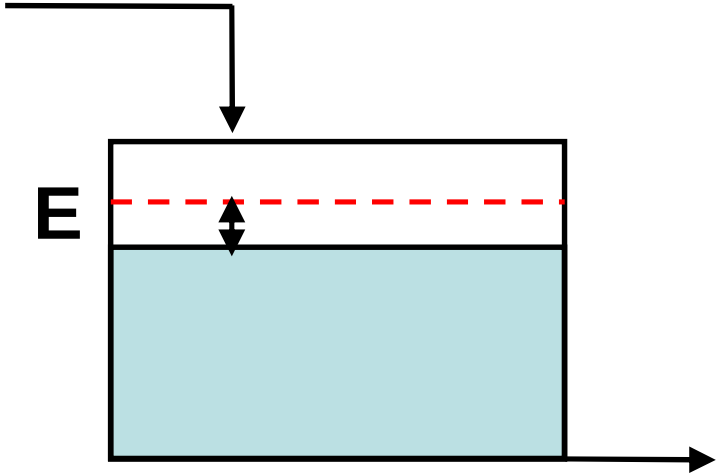


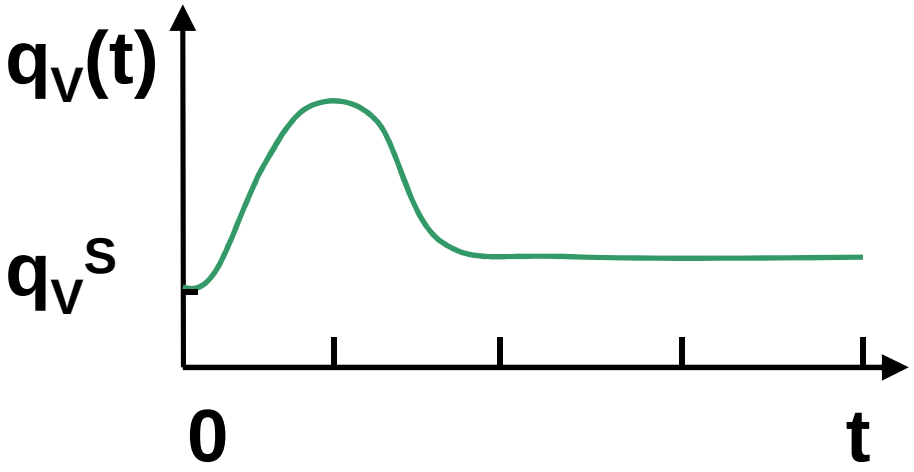


$$E = W - Y$$

Zákon riadenia

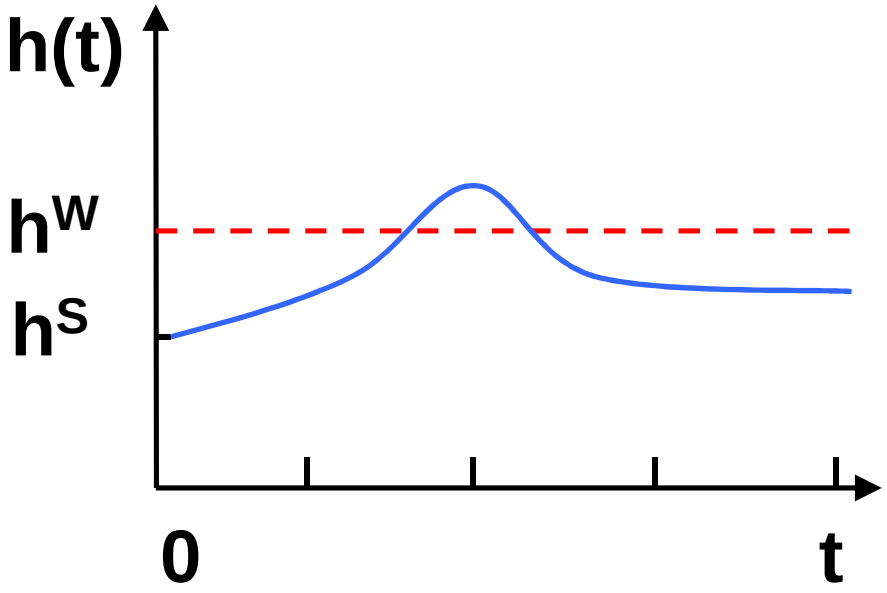


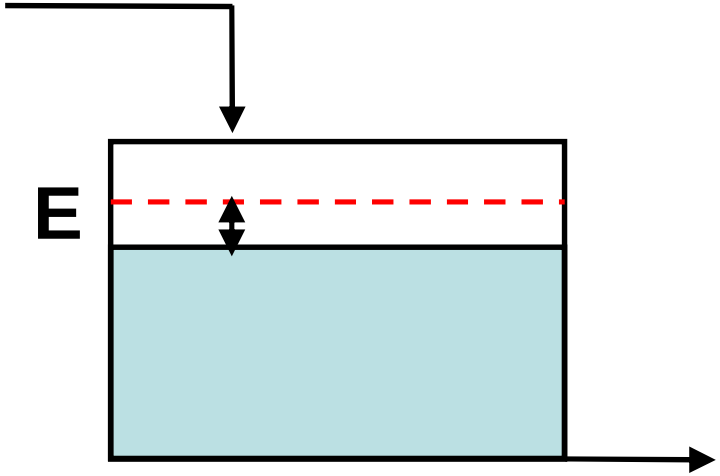


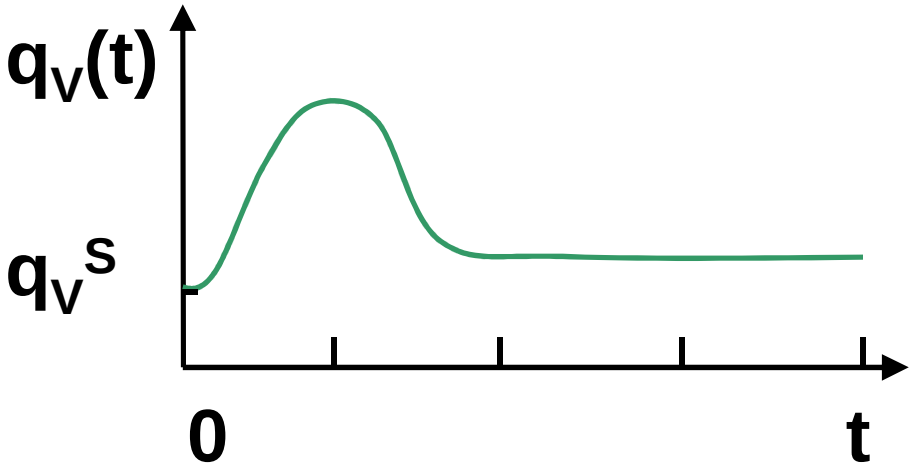


$$E(\infty) = W(\infty) - Y(\infty)$$

Zákon riadenia

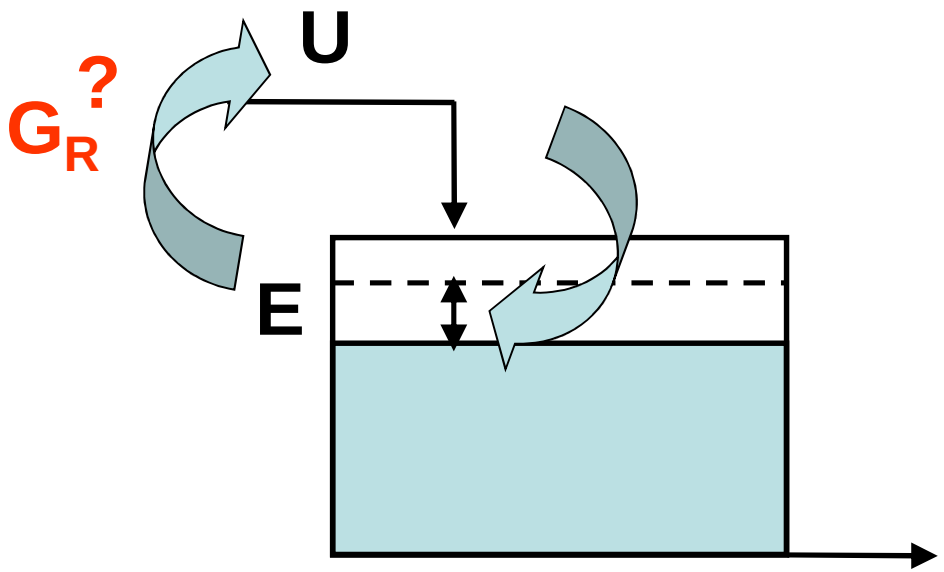




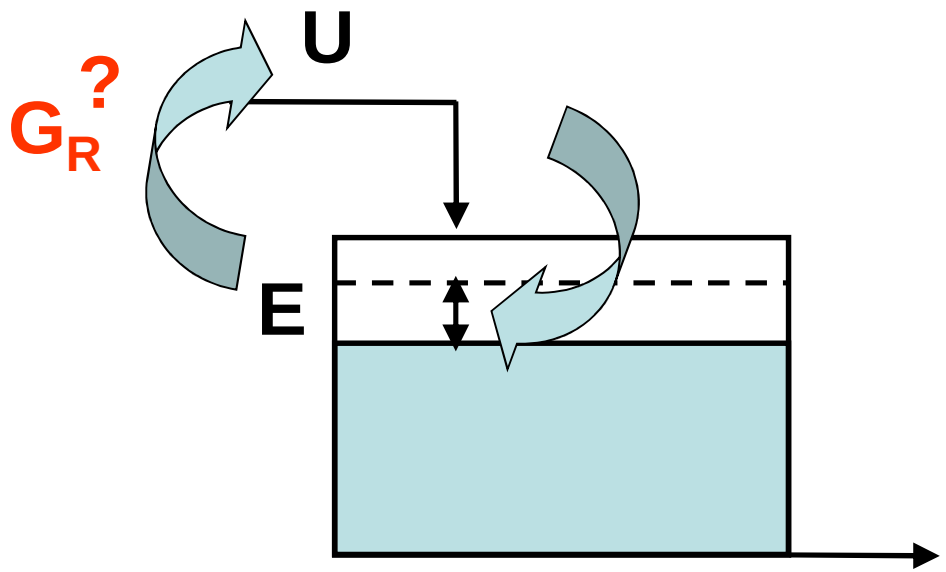


TRO: $E(\infty) = W(\infty) - Y(\infty)$

Zákon riadenia

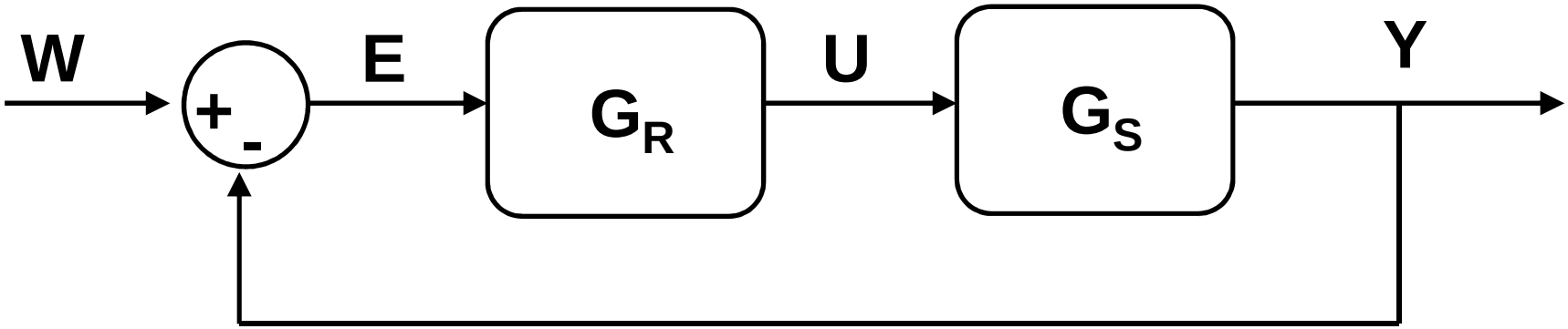


Zákon riadenia

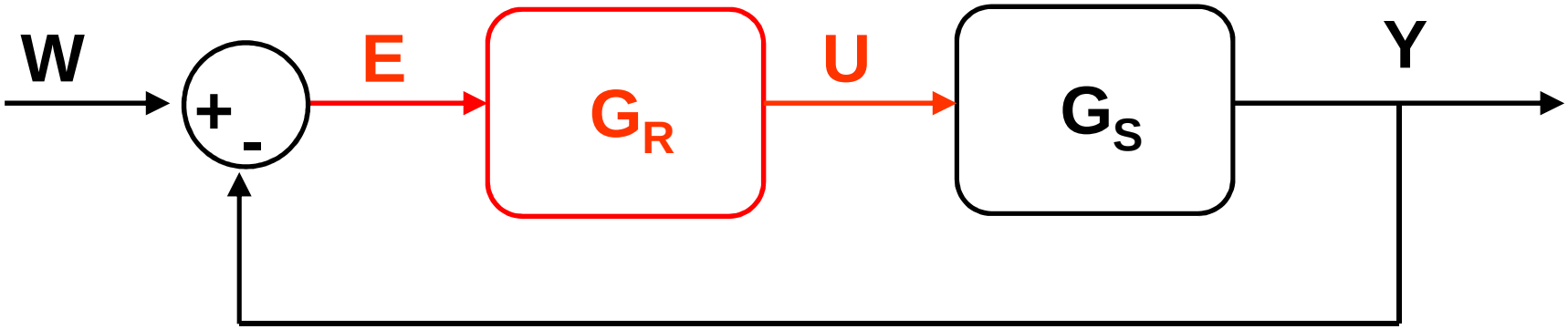


fyzické dynamické zariadenie, ktoré na základe regulačnej odchýlky vypočíta veľkosť akčného zásahu tak, aby výsledná regulačná odchýlka bola čo najmenšia

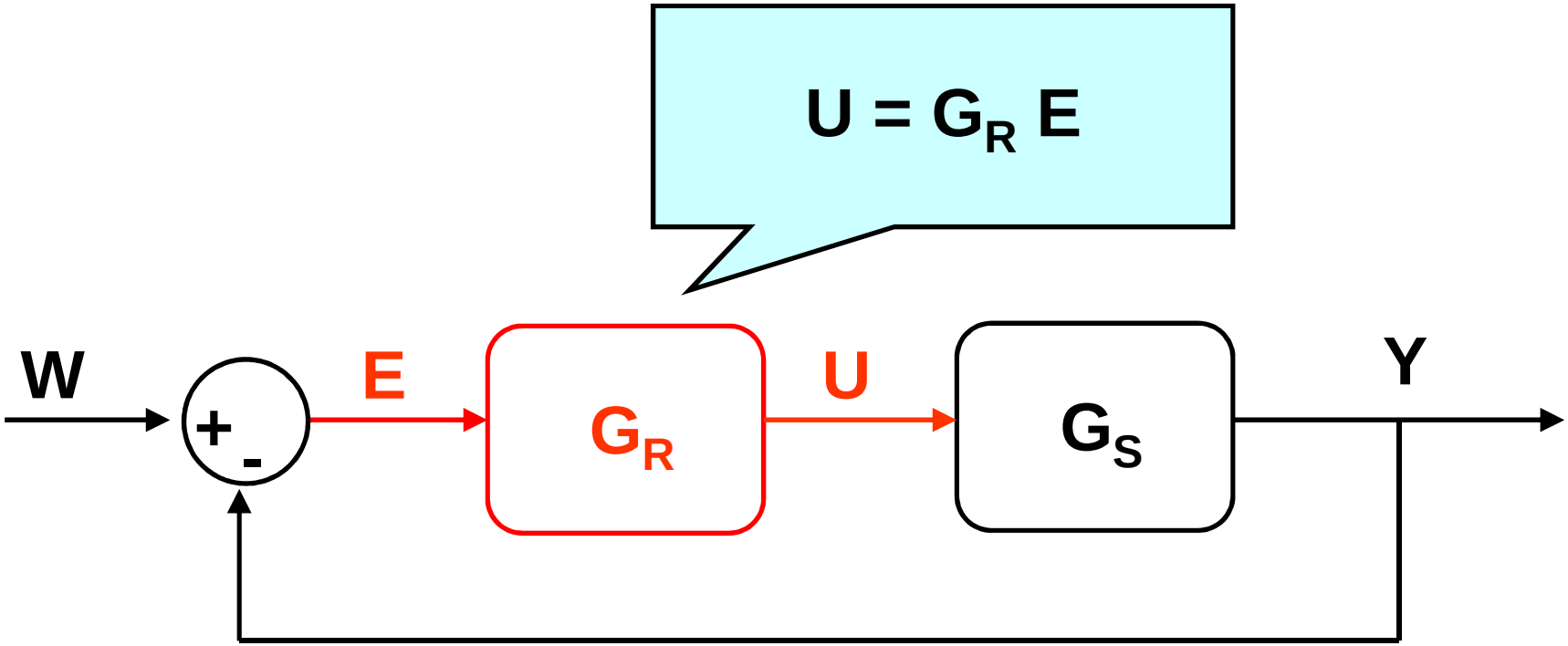
Zákon riadenia



Zákon riadenia



Zákon riadenia



Zákon riadenia

$$u(t) = G_R e(t)$$

Zákon riadenia

- **Proporcionálny regulátor:**

$$u(t) = G_{R,P} e(t)$$

Zákon riadenia

- **Proporcionálny regulátor:**

$$u(t) = G_{R,P} e(t)$$

- **Prenos:** $G_{R,P} = Z_R$

- **Zákon riadenia:**

$$u(t) = Z_R e(t)$$

Zákon riadenia

- **Proporcionálno-integračný regulátor:**

$$u(t) = G_{R,PI} e(t)$$

Zákon riadenia

- **Proporcionálno-integračný regulátor:**

$$u(t) = G_{R,PI} e(t)$$

- **Prenos:**

$$G_{R,PI} = \frac{Z_R s + \frac{Z_R}{T_I}}{s}$$

- **Zákon riadenia:**

$$u(t) = Z_R e(t) + \frac{Z_R}{T_I} \int_0^t e(\tau) d\tau$$

Zákon riadenia

- **Proporcionálno-integračný regulátor:**

$$u(t) = G_{R,PI} e(t)$$

- **Prenos:**

$$G_{R,PI} = \frac{Z_R s + \frac{Z_R}{T_I}}{s}$$

- **Zákon riadenia:**

$$u(t) = u_P(t) + u_I(t)$$

Zákon riadenia

- **Proporcionálno-integračný regulátor:**

$$u(t) = G_{R,PI} e(t)$$

- **Prenos:**

$$G_{R,PI} = \frac{Z_R s + \frac{Z_R}{T_I}}{s}$$

- **Zákon riadenia:**

$$u_I(t) = \frac{Z_R}{T_I} \int_0^t e(\tau) d\tau$$

Zákon riadenia

- **Proporcionálno-integračný regulátor:**

$$u(t) = G_{R,PI} e(t)$$

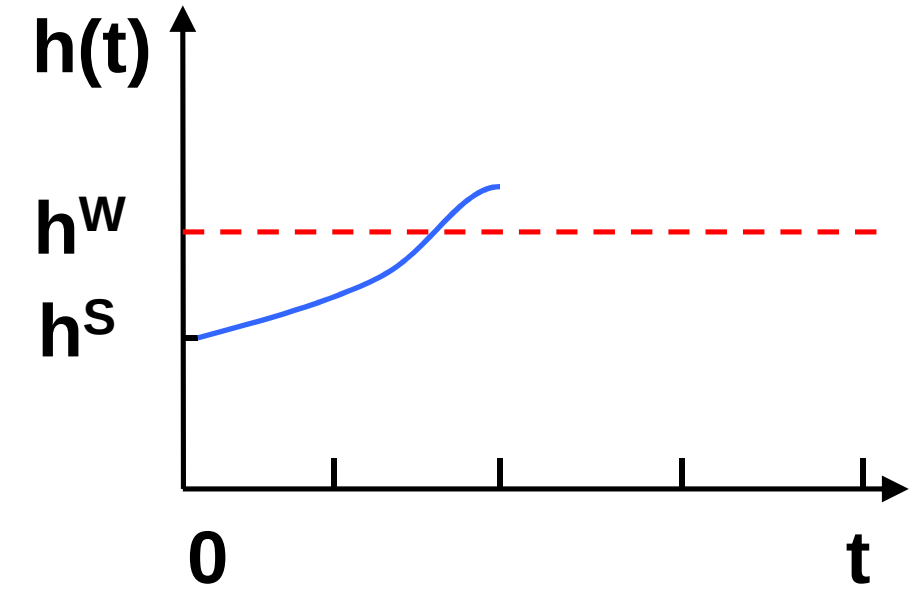
- **Prenos:**

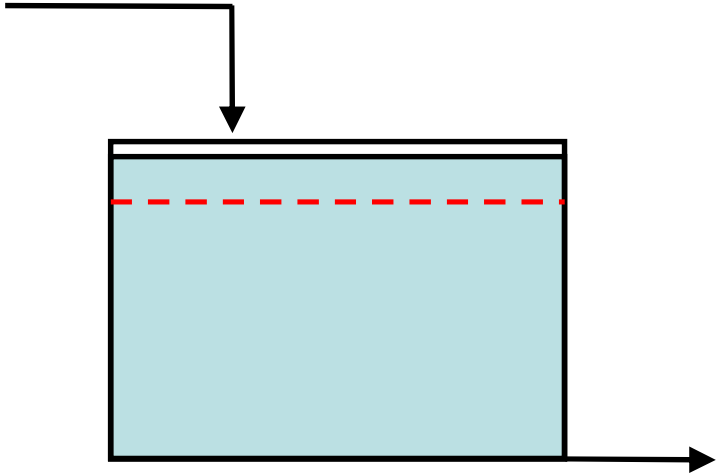
$$G_{R,PI} = \frac{Z_R s + \frac{Z_R}{T_I}}{s}$$

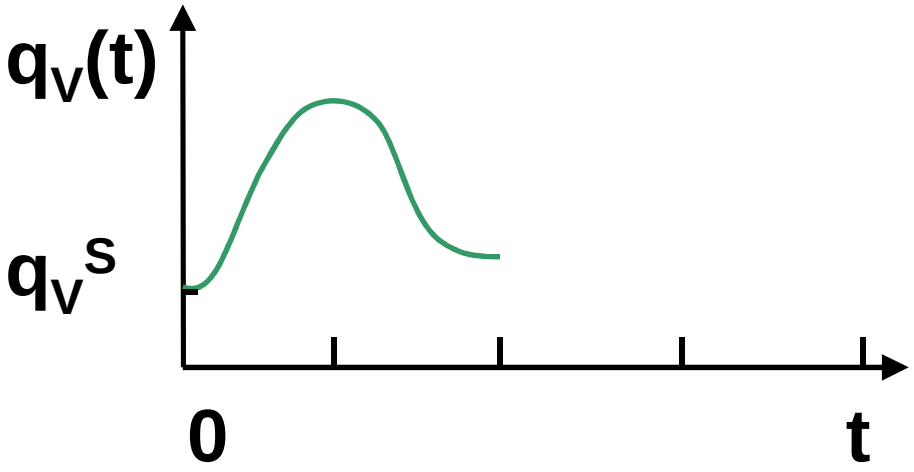
- **Zákon riadenia:**

$$\frac{du_I(t)}{dt} = \frac{Z_R}{T_I} e(t)$$

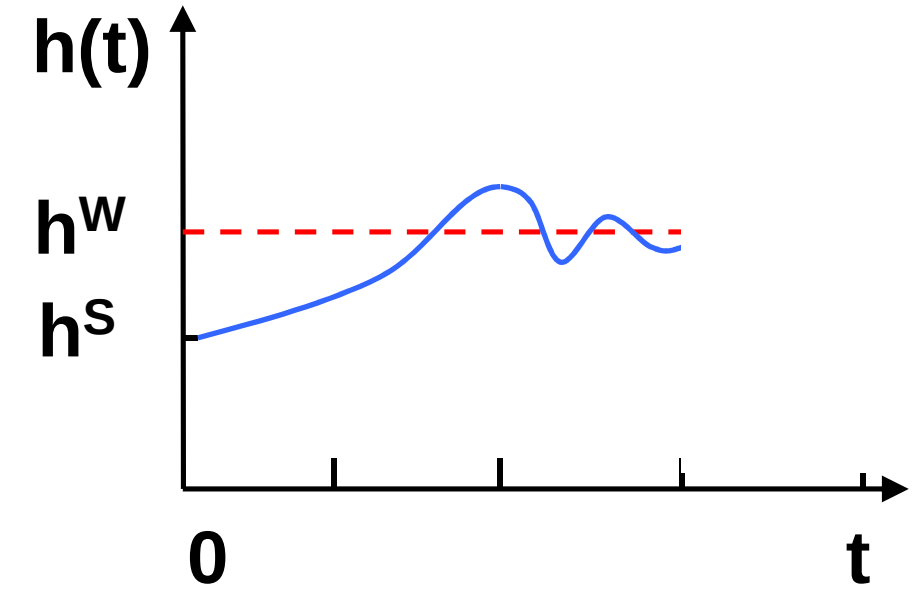
Zákon riadenia

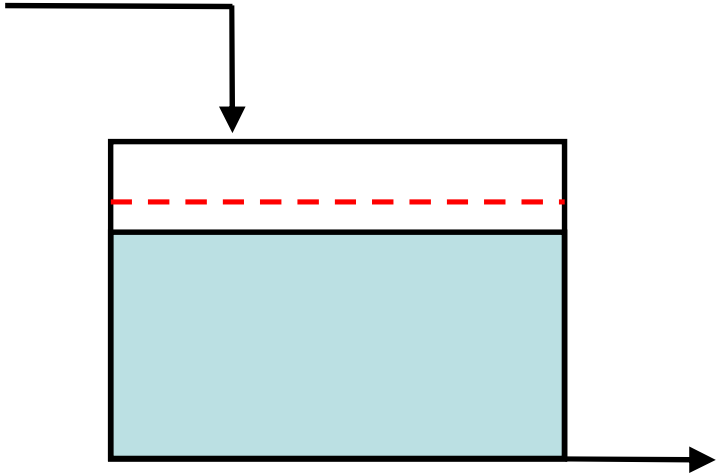


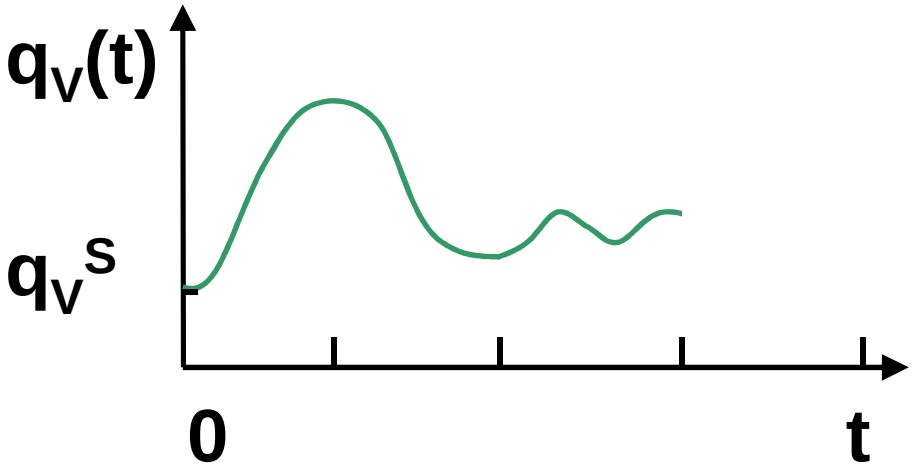




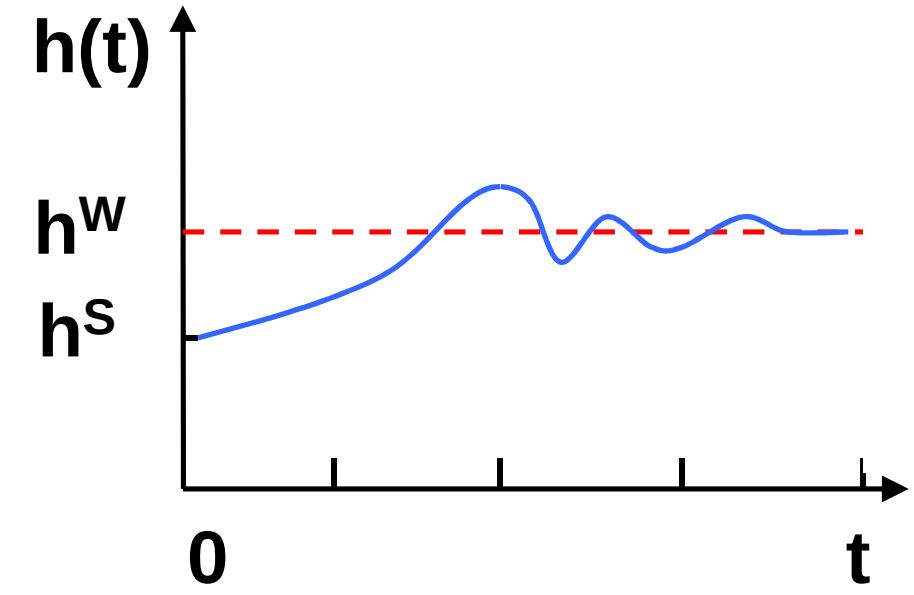
Zákon riadenia

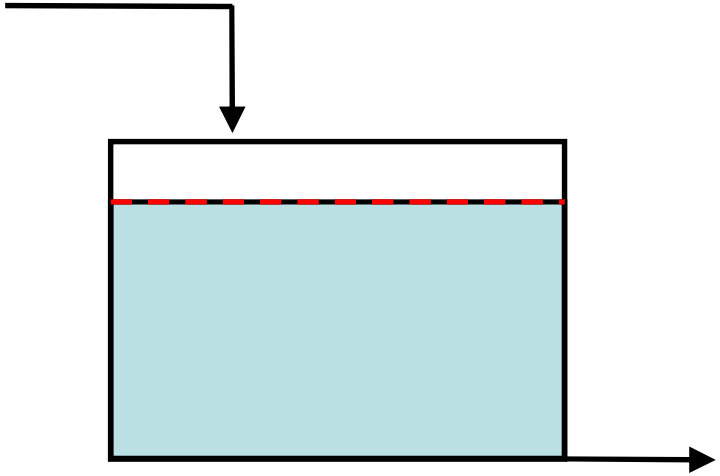


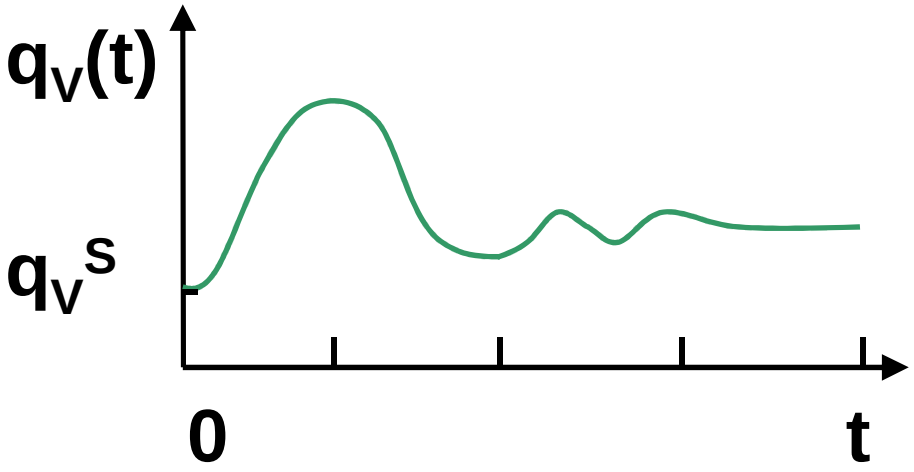




Zákon riadenia







Zákon riadenia

- **Proporcionálno-integračno derivačný regulátor:**

$$u(t) = G_{R,PID} e(t)$$

Zákon riadenia

- **Proporcionálno-integračno derivačný regulátor:**

$$u(t) = G_{R,PID} e(t)$$

- **Prenos:**

$$G_{R,PID} = \frac{Z_R s + \frac{Z_R}{T_I} + Z_R T_D s^2}{s}$$

- **Zákon riadenia:**

$$u(t) = Z_R e(t) + \frac{Z_R}{T_I} \int_0^t e(\tau) d\tau + Z_R T_D \frac{de(t)}{dt}$$

Zákon riadenia

- **Proporcionálno-derivačný regulátor:**

$$u(t) = G_{R,PD} e(t)$$

- **Prenos:** $$G_{R,PD} = \frac{Z_R s + Z_R T_D s^2}{s}$$

- **Zákon riadenia:**

$$u(t) = Z_R e(t) + Z_R T_D \frac{de(t)}{dt}$$

Zákon riadenia

- **Proporcionálno-derivačný regulátor:**

$$u(t) = G_{R,PD} e(t)$$

- **Prenos:** $G_{R,PD} = Z_R + Z_R T_D s$

- **Zákon riadenia:**

$$u(t) = Z_R e(t) + Z_R T_D \frac{de(t)}{dt}$$

Zákon riadenia

- **Proporcionálno-derivačný regulátor:**

$$u(t) = G_{R,PD} e(t)$$

- **Prenos:** $G_{R,PD} = Z_R + Z_R T_D s$

- **Zákon riadenia:**

$$u(t) = u_P(t) + u_D(t)$$

Zákon riadenia

- **Proporcionálno-derivačný regulátor:**

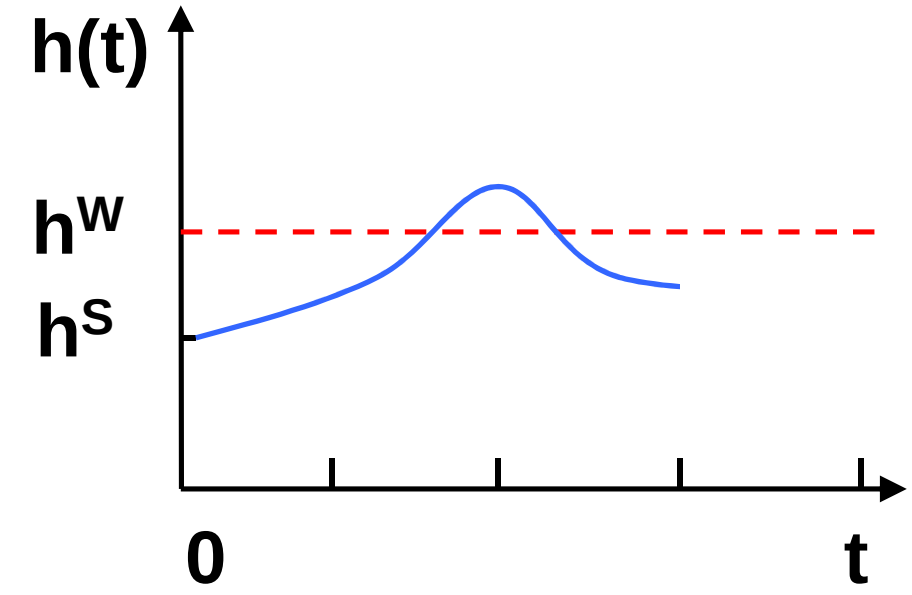
$$u(t) = G_{R,PD} e(t)$$

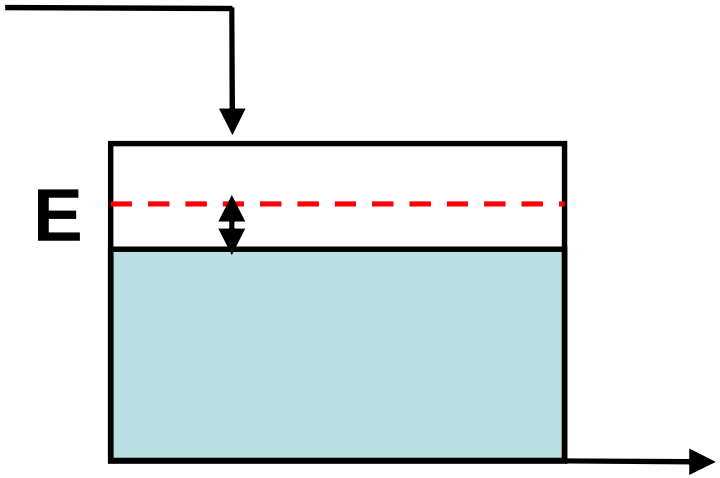
- **Prenos:** $G_{R,PD} = Z_R + Z_R T_D s$

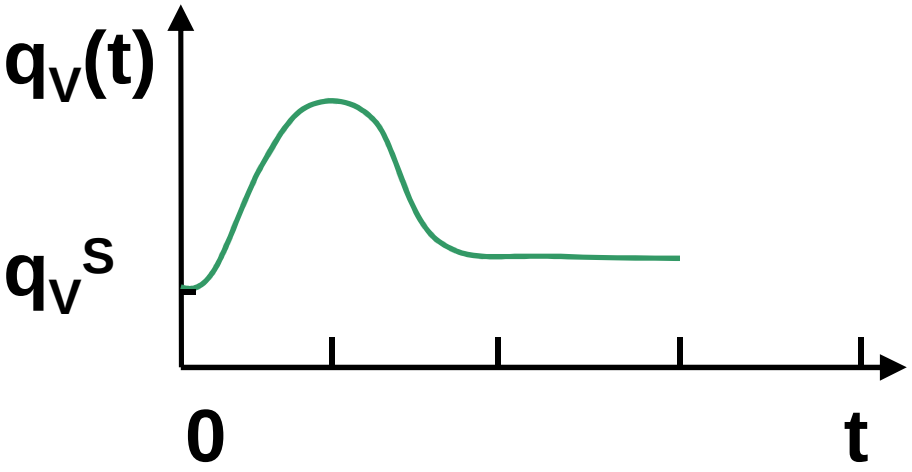
- **Zákon riadenia:**

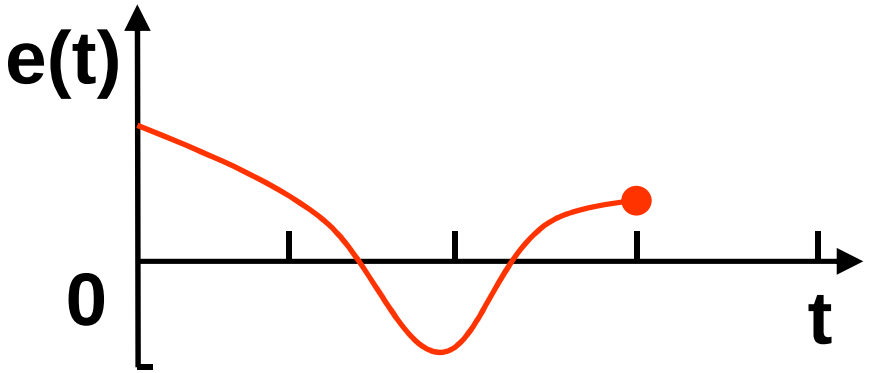
$$u_D(t) = Z_R T_D \frac{de(t)}{dt}$$

Zákon riadenia

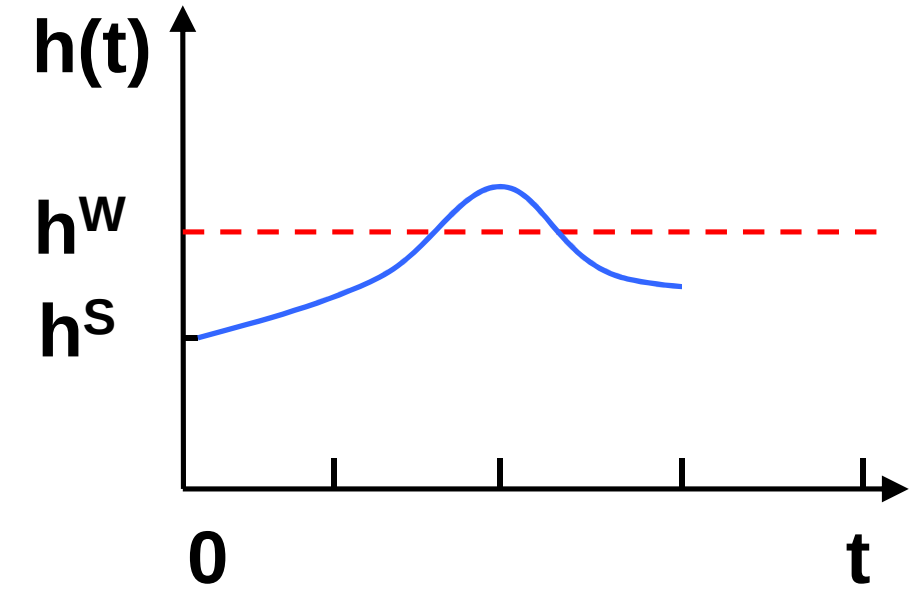


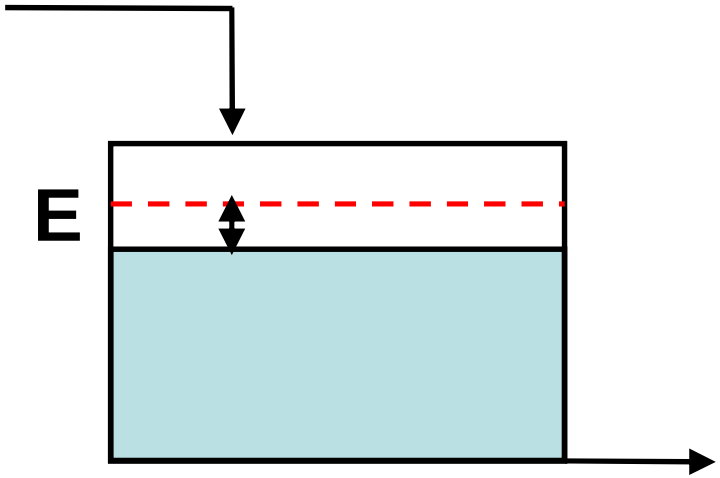


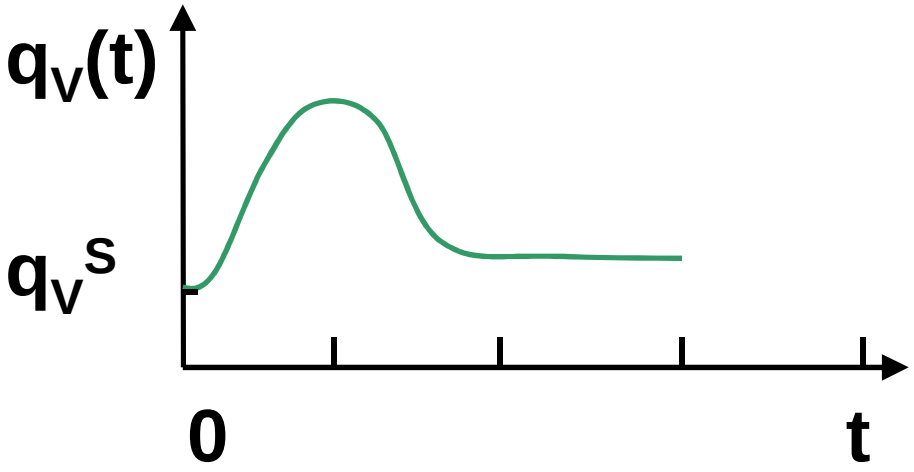


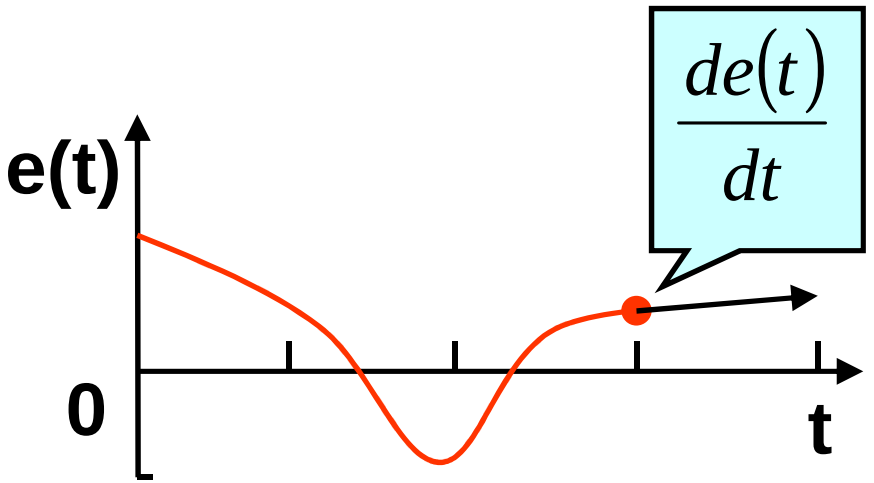


Zákon riadenia









7. Zadanie z LCRP – teoretická časť

- URO
- prenos URO
- CHR URO
- zákon riadenia
- Routhovo-Schurovo kritérium stability

Routhovo-Schurovo kritérium stability

- **Systém:**

$$G_S = \frac{8}{s^3 + 6s^2 + 11s + 6}$$

- **Proporcionálno-integračný regulátor:**

$$G_{R,PI} = \frac{4s + \frac{4}{20}}{s}$$

- **Charakteristická rovnica:**

$$1 + G_R G_S = 0$$

Routhovo-Schurovo kritérium stability

- **Charakteristická rovnica:**

$$1 + G_R G_S = 0$$

Routhovo-Schurovo kritérium stability

- **Charakteristická rovnica:**

$$s^4 + 6s^3 + 11s^2 + 38s + 1.6 = 0$$

Routhovo-Schurovo kritérium stability

- algoritmus R-S:

I.:	1	6	11	38	1.6	1.) koeficienty CHR

Routhovo-Schurovo kritérium stability

	a_4	a_3	a_2	a_1	a_0
I.:	1	6	11	38	1.6

- algoritmus R-S:

1.) koeficienty CHR

Routhovo-Schurovo kritérium stability

	a_4	a_3	a_2	a_1	a_0
I.:	1	6	11	38	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

Routhovo-Schurovo kritérium stability

	a_4	a_3	a_2	a_1	a_0
I.:	1	<u>6</u>	11	<u>38</u>	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

$k_1 = a_4/a_3 = 1/6$

Routhovo-Schurovo kritérium stability

I.: 1 6 11 38 1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) odčítať od nepodčiarknutých koeficientov nasledujúci koeficient krát parameter k_1

Routhovo-Schurovo kritérium stability

I.: 1 6 11 38 1.6

1-6*1/6 = 0

II.: 0

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) odčítať od nepodčiarknutých koeficientov nasledujúci koeficient krát parameter k_1

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:	0	6			

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) odčítať od nepodčiarknutých koeficientov nasledujúci koeficient krát parameter k_1

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
			11-38*1/6		
II.:	0	6	28/6		

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) odčítať od nepodčiarknutých koeficientov nasledujúci koeficient krát parameter k_1

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:	0	6	28/6	38	

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) odčítať od nepodčiarknutých koeficientov nasledujúci koeficient krát parameter k_1

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:	0	6	28/6	38	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) odčítať od nepodčiarknutých koeficientov nasledujúci koeficient krát parameter k_1

Routhovo-Schurovo kritérium stability

I.:	1	<u>6</u>	11	<u>38</u>	1.6
II.:	0	6	28/6	38	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) použiť k_1

5.) otestovať, či sú koeficienty kladné

Routhovo-Schurovo kritérium stability

I.: 1 6 11 38 1.6

II.: 0 6 28/6 38 1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) použiť k_1

5.) otestovať, či sú koeficienty kladné

Routhovo-Schurovo kritérium stability

I.:	1	<u>6</u>	11	<u>38</u>	1.6
		a_3	a_2	a_1	a_0
II.:		6	28/6	38	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) použiť k_1

5.) otestovať koef.

6.) otestovať rád polynómu

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
		a_3	a_2	a_1	a_0
II.:		6	28/6	38	1.6

$$6s^3 + 4.7s^2 + 38s + 1.6 = 0$$

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

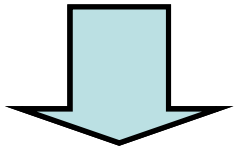
4.) použiť k_1

5.) otestovať koef.

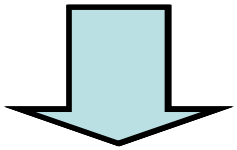
6.) otestovať rád polynómu

Routhovo-Schurovo kritérium stability

I.:	1	<u>6</u>	11	<u>38</u>	1.6
		a_3	a_2	a_1	a_0
II.:		6	28/6	38	1.6



$$6s^3 + 4.7s^2 + 38s + 1.6 = 0$$



$$\dim\{p_{II}(s)\} = 3 > 2$$

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) použiť k_1

5.) otestovať koef.

6.) otestovať rád polynómu

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) použiť k_1

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) použiť k_1

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_1

4.) použiť k_1

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
		a_3	a_2	a_1	a_0
II.:		6	28/6	38	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_1

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
		a_3	a_2	a_1	a_0
II.:		6	28/6	38	1.6

$k_2 = a_3/a_2$

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_1

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
		a_3	a_2	a_1	a_0
II.:		6	28/6	38	1.6

$k_2 = 6/(28/6)$

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_1

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.: 1 6 11 38 1.6

II.: 6 28/6 38 1.6

6-(28/6)*(36/28)=0

III.: 0

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_2

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6
III.:		0	28/6		

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_2

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6
	38-1.6*(36/28)=1258/35				
III.:		0	4.7	1258/35	

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_2

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6
III.:		0	4.7	35.9	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_2

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6
III.:		0	4.7	35.9	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_2

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6
III.:		0	4.7	35.9	1.6

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_2

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6
			a_2	a_1	a_0
III.:			4.7	35.9	1.6

$$4.7s^2 + 35.9s + 1.6 = 0$$

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_2

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6
			a_2	a_1	a_0
III.:			4.7	35.9	1.6

$$\dim\{p_{III}(s)\} = 2$$

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_2

5.) otestovať koef.

6.) otestovať rád

7.) späť na krok 2.)

Routhovo-Schurovo kritérium stability

I.:	1	6	11	38	1.6
II.:		6	28/6	38	1.6
			a_2	a_1	a_0
III.:			4.7	35.9	1.6

$$\dim\{p_{III}(s)\} = 2$$

- algoritmus R-S:

1.) koeficienty CHR

2.) podčiarknúť každý druhý

3.) parameter k_2

4.) použiť k_2

5.) otestovať koef.

6.) otestovať rád

7.) koniec – stabilné

Routhovo-Schurovo kritérium stability

- algoritmus R-S:

1.) i = 0, určiť koeficienty CHR

2.) i:=i+1, podčiarknúť každý druhý koeficient

3.) parameter $k_i = a_n/a_{n-1}$

4.) odčítať od nepodčiarknutých koeficientov nasledujúci koeficient krát parameter k_i

5.) otestovať koeficienty $p_i(s) > 0$

6.) otestovať rád:
ak $\dim\{p_i(s)\} > 2$ choď na krok 2.) inak Koniec