Generierung des Eingangssingals für Barrier Bucket RF Systeme and der GSI

TECHNISCHE UNIVERSITÄT DARMSTADT

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Projektseminar Beschleunigertechnik

Outline

1. Einführung
   - Problemstellung
   - Zielsetzung
2. Gerätekommunikation
3. Code
   - das Design
   - Gegeben
   - Evaluierung
4. Ausblick

Problemstellung

- Barrier-Bucket System
- Ziel

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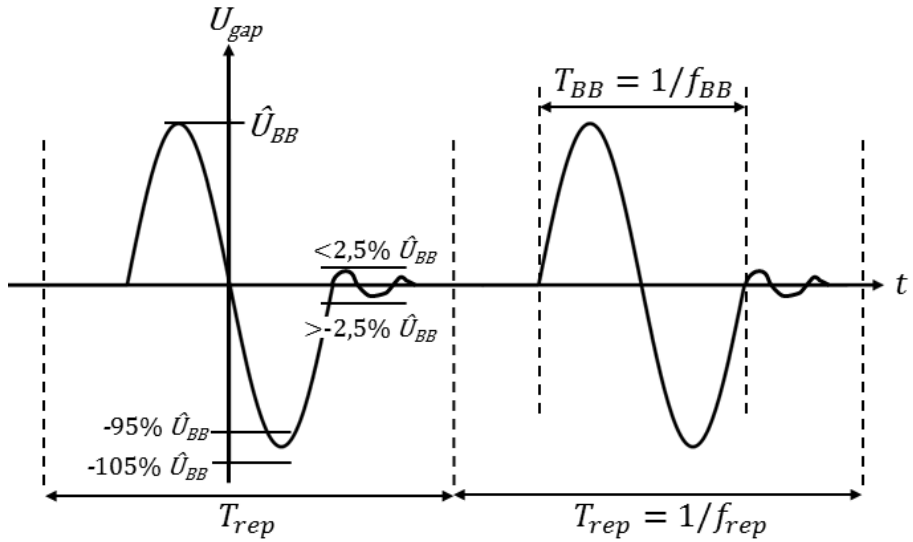
- Barrier-Bucket System :
  - Longitudinale Manipulation der Bunches
- Ziel

Problemstellung

- Barrier-Bucket System :
  - Longitudinale Manipulation der Bunches
- Ziel :
  - Gap Spannung in Form einer Ein-Sinus Periode



- Qualität das Signals

Zielsetzung

Erreichtes: Dokumentation und Gerätekommunikation

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  - Bedienung des Programms
  - Ausführliches Kommentieren der Code-Funktionalität
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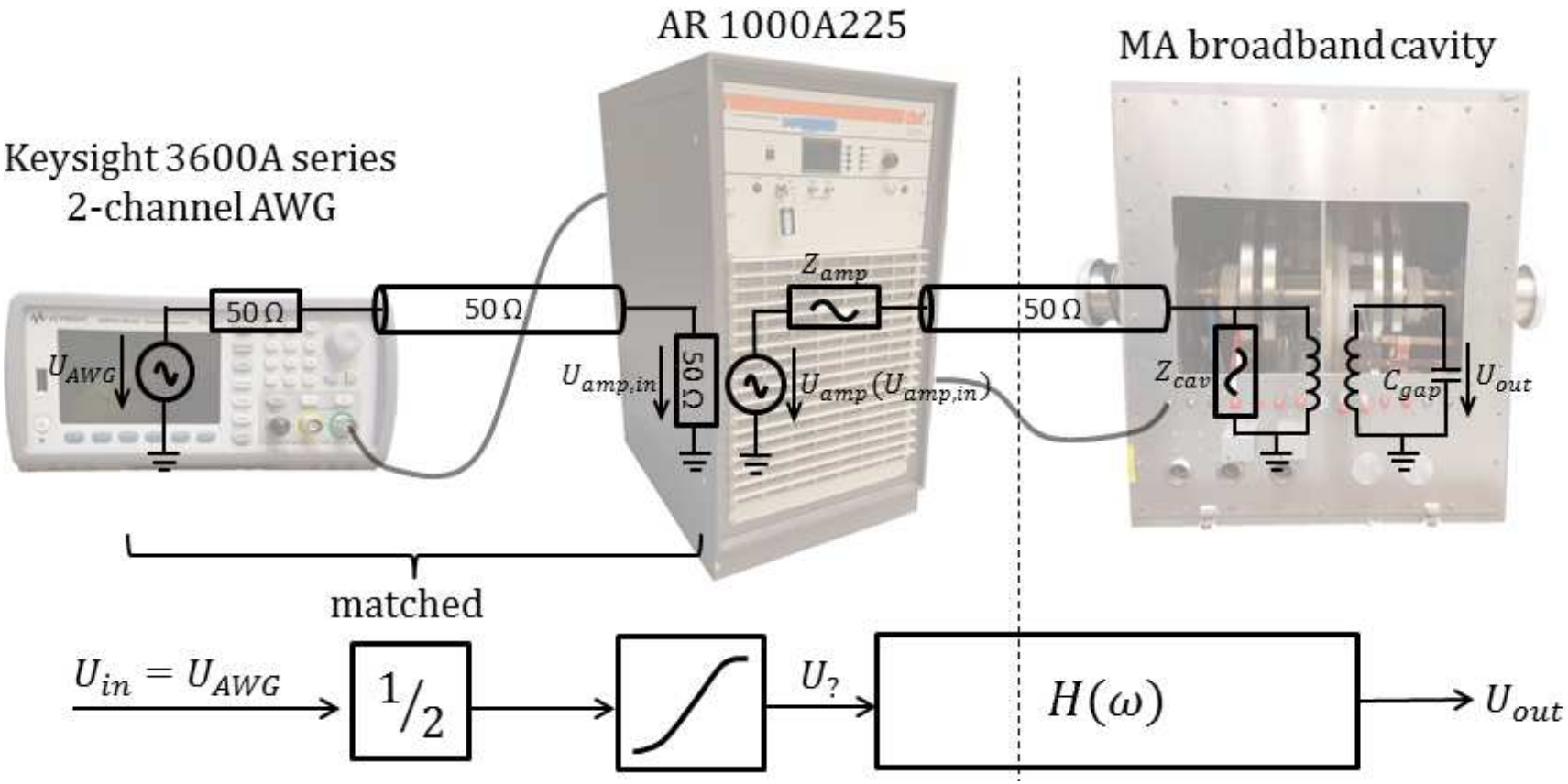
- Gerätekommunikation :
  - Treiber und Programmer-Manuals zur Nutzung des Programms von anderen Geräten aus
  - Laufzeitoptimierung durch Abfrage von Gerätezuständen mittels VISA
  - Verbesserung der Auflösung des Signals durch Anpassung der Darstellung des Oszilloskops mittels VISA

Code: Das Design



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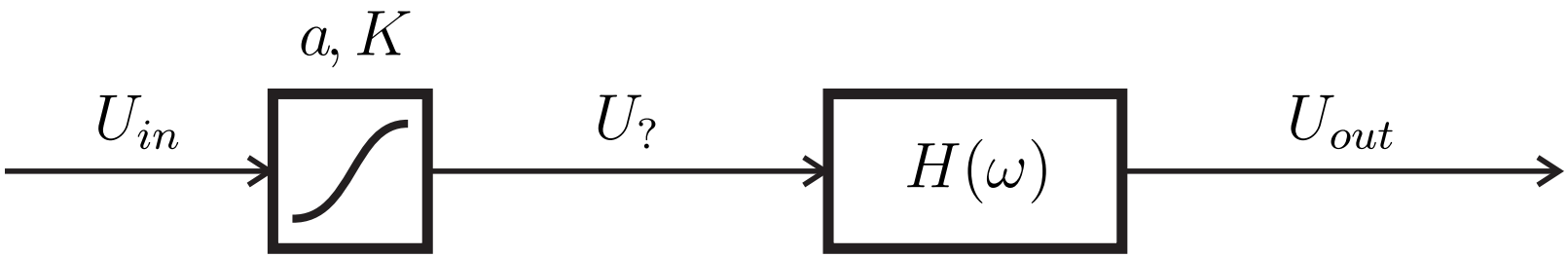

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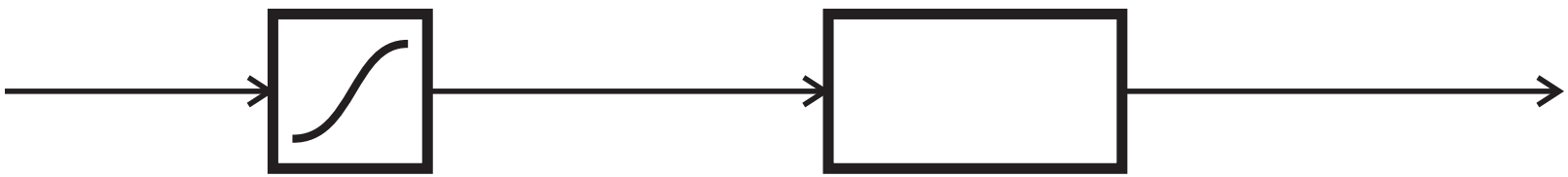

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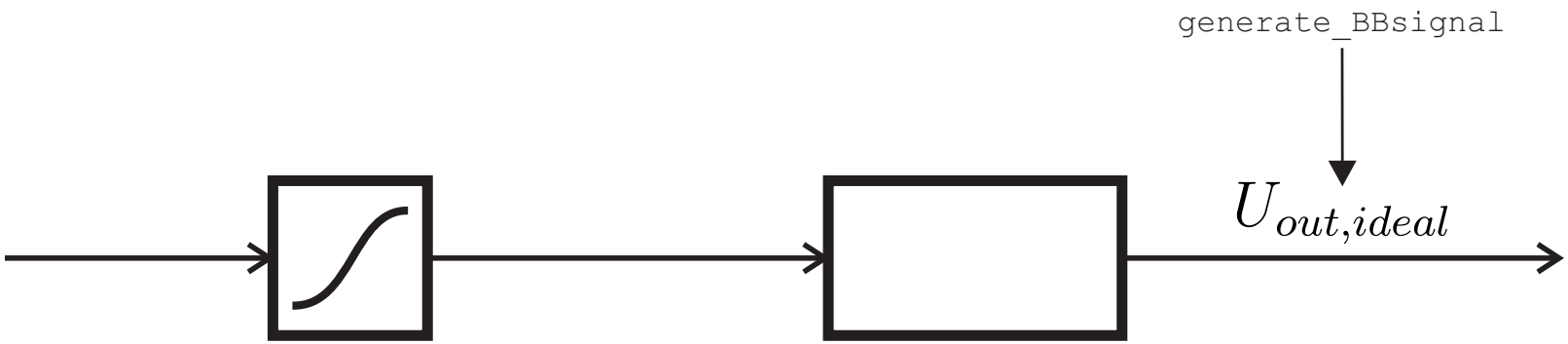


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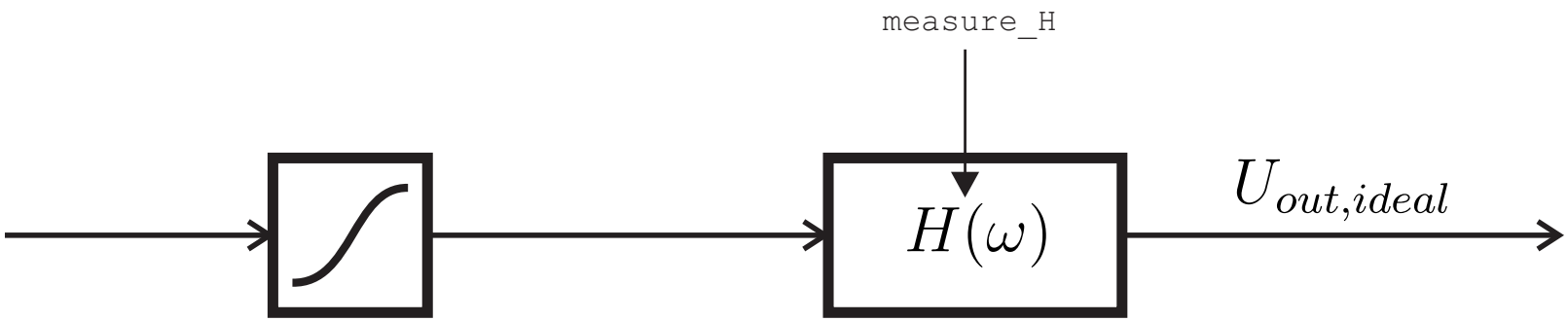


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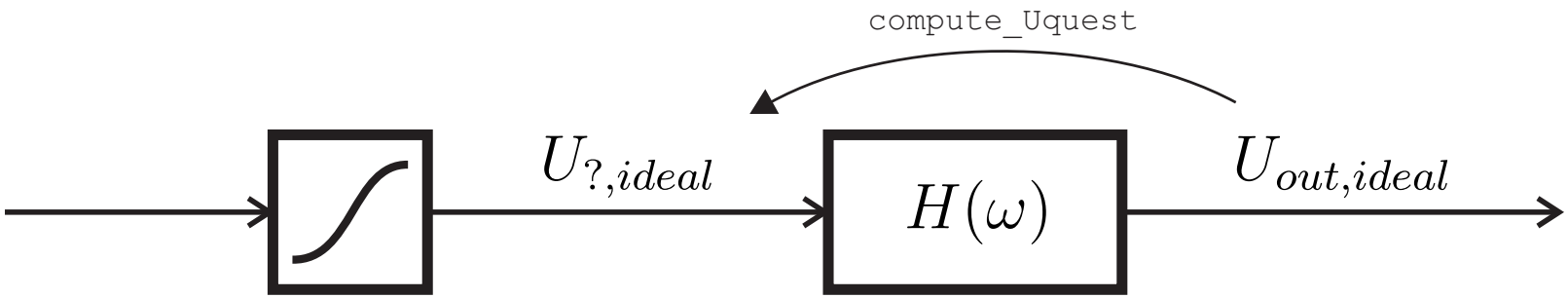


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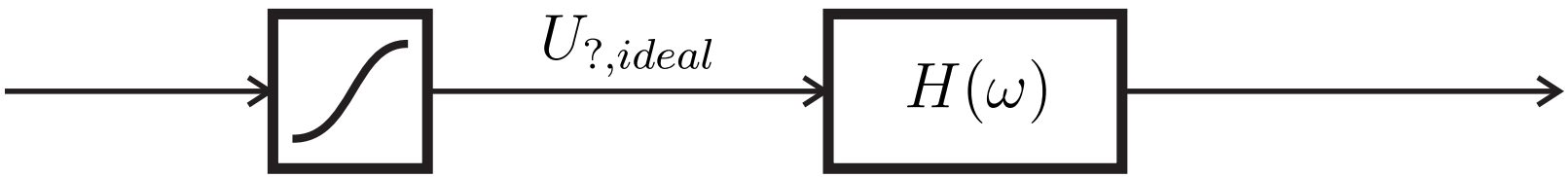


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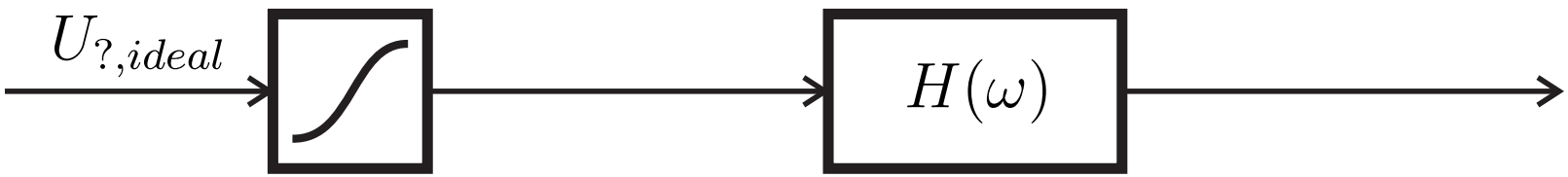


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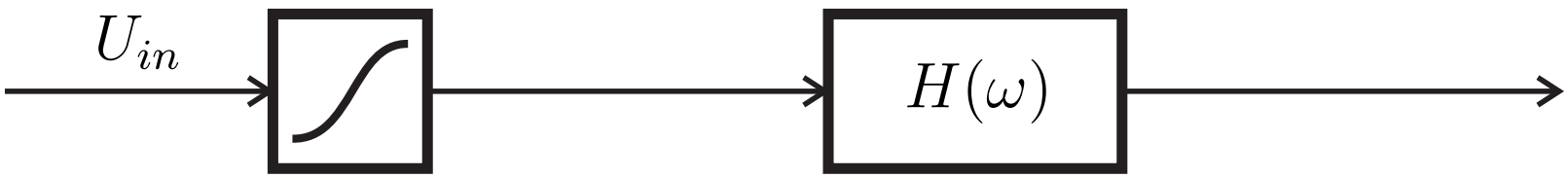


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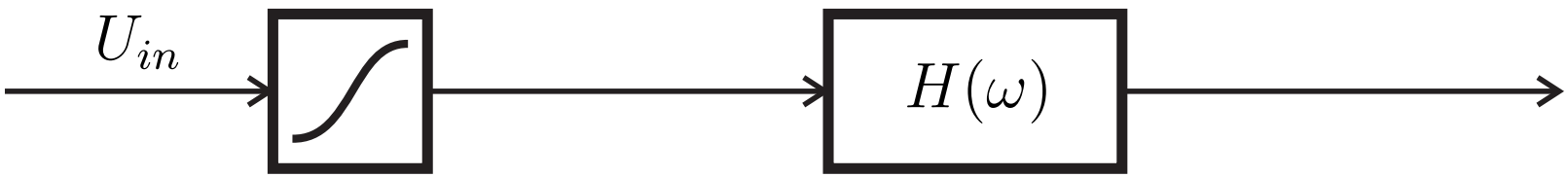


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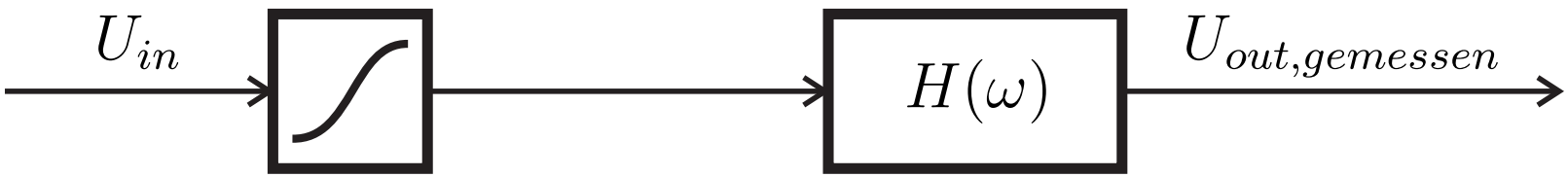


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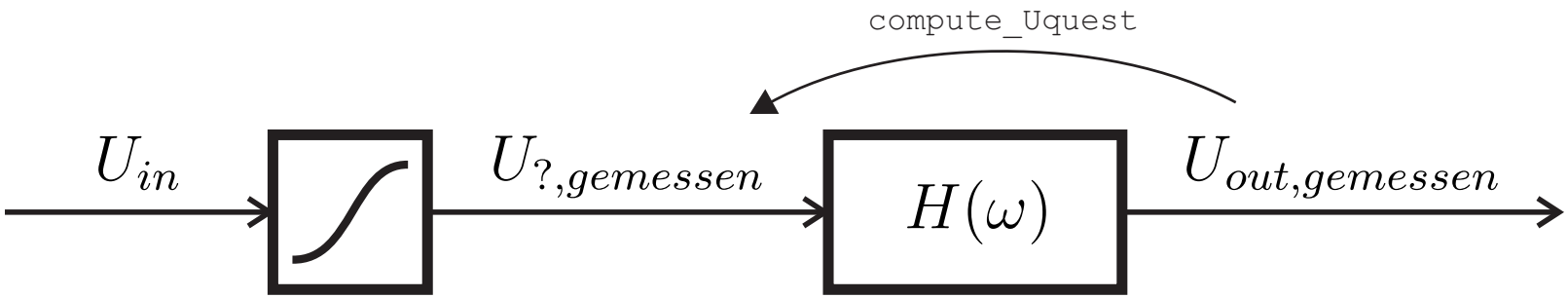


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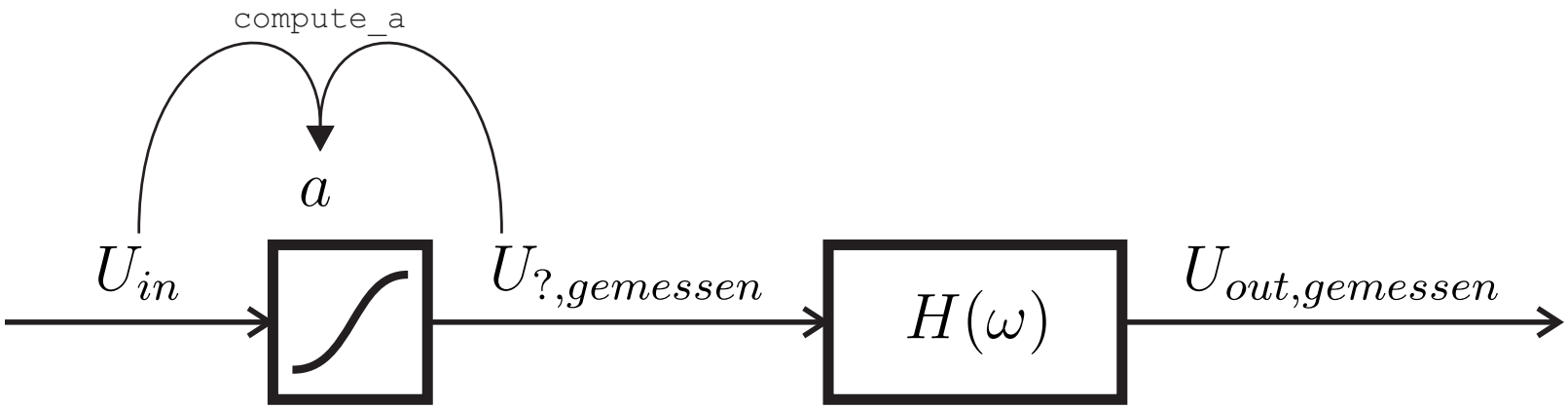


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7 a = compute_a ( Uin, Uquest_measured, N )
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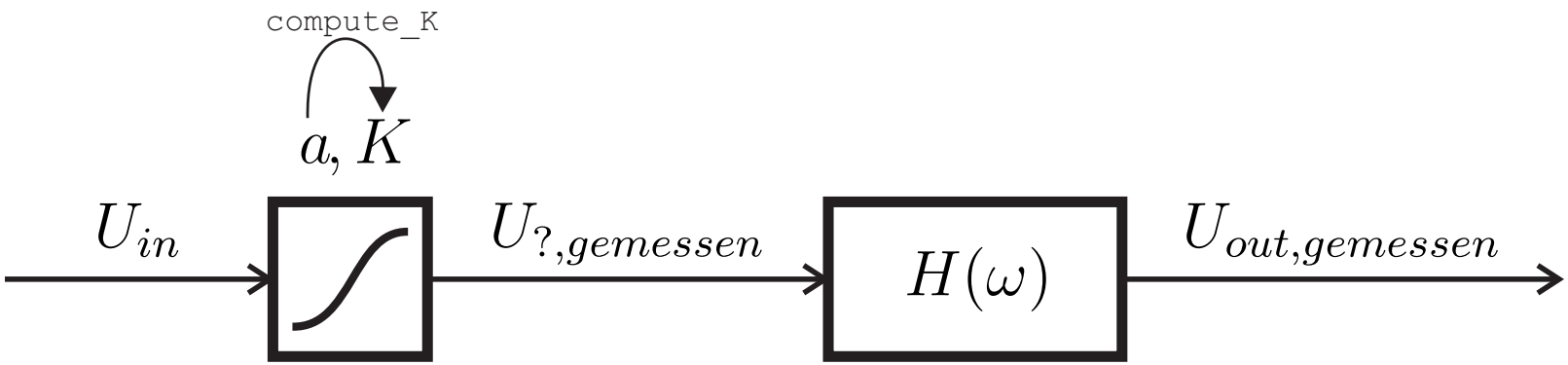


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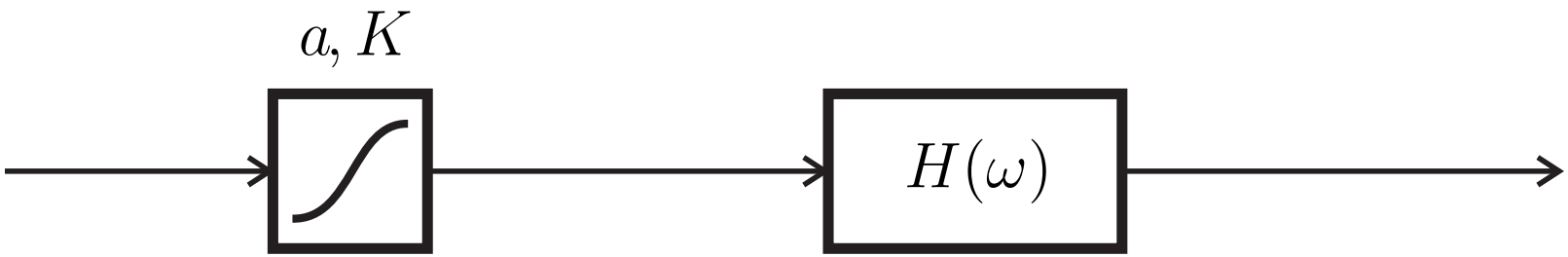


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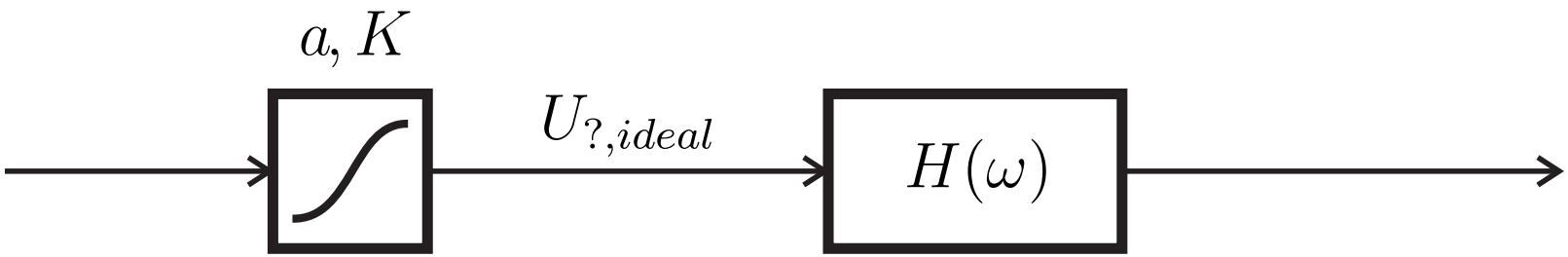


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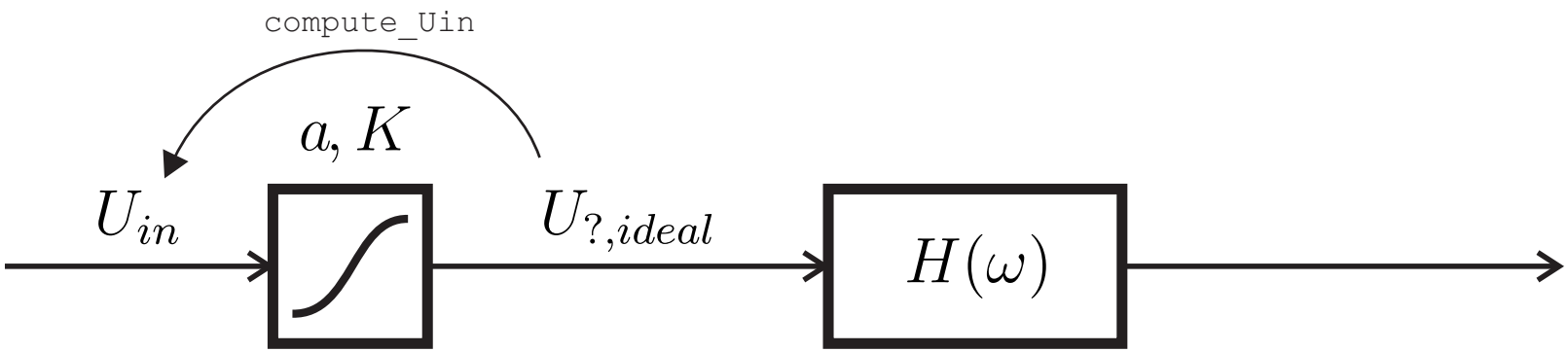


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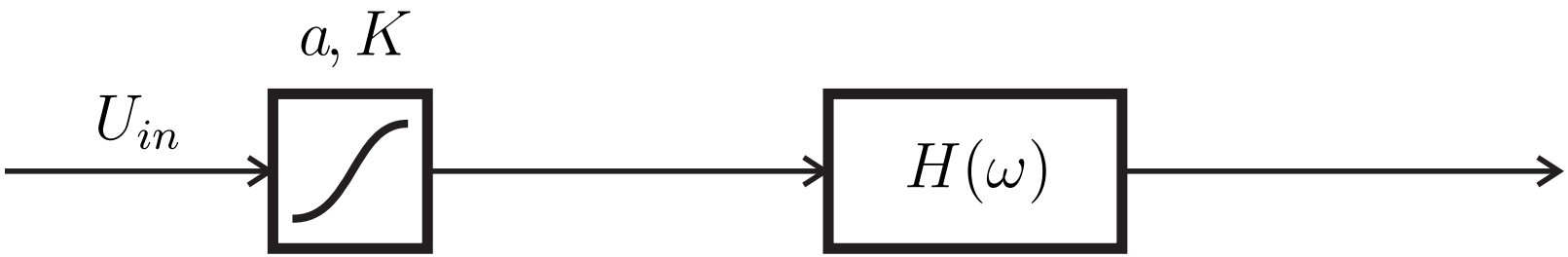


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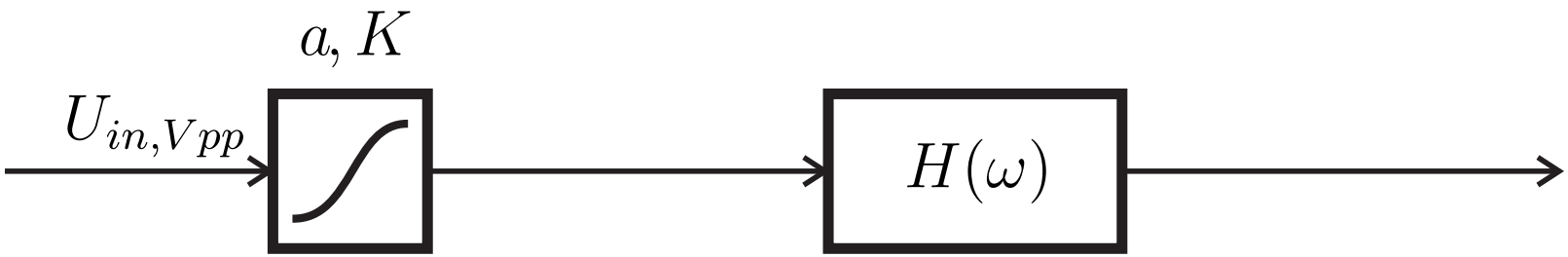


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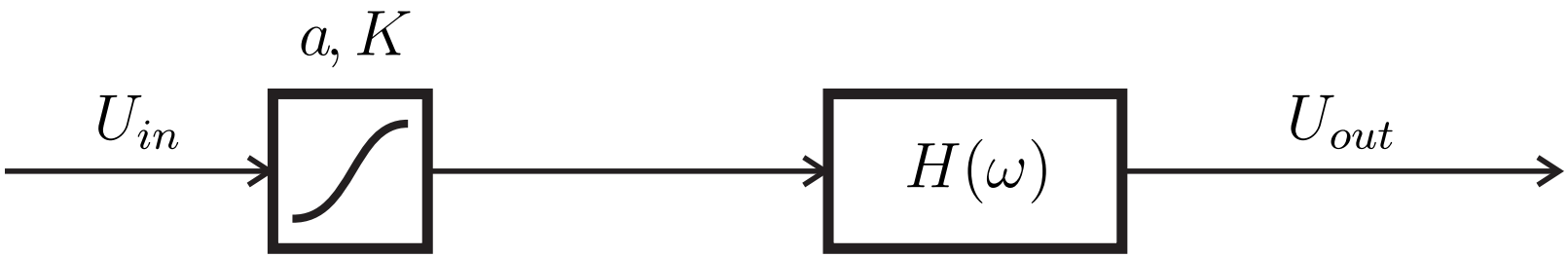


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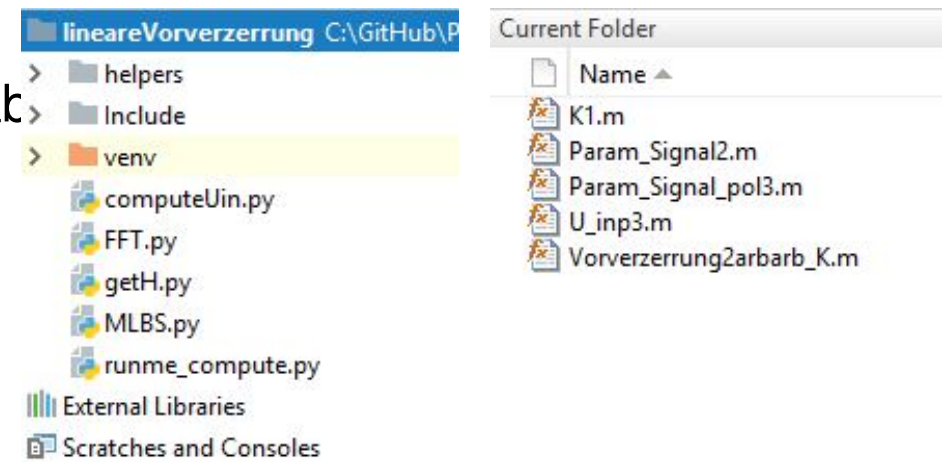

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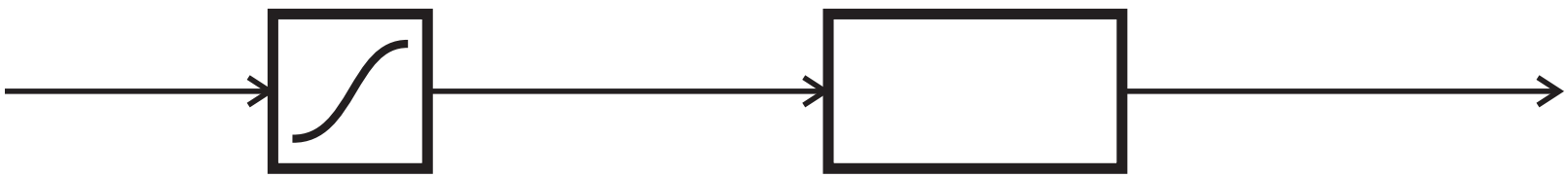
  - Nur fürs Testen von `measure_Uout` sind Geräte notwendig

Code: Evaluierung



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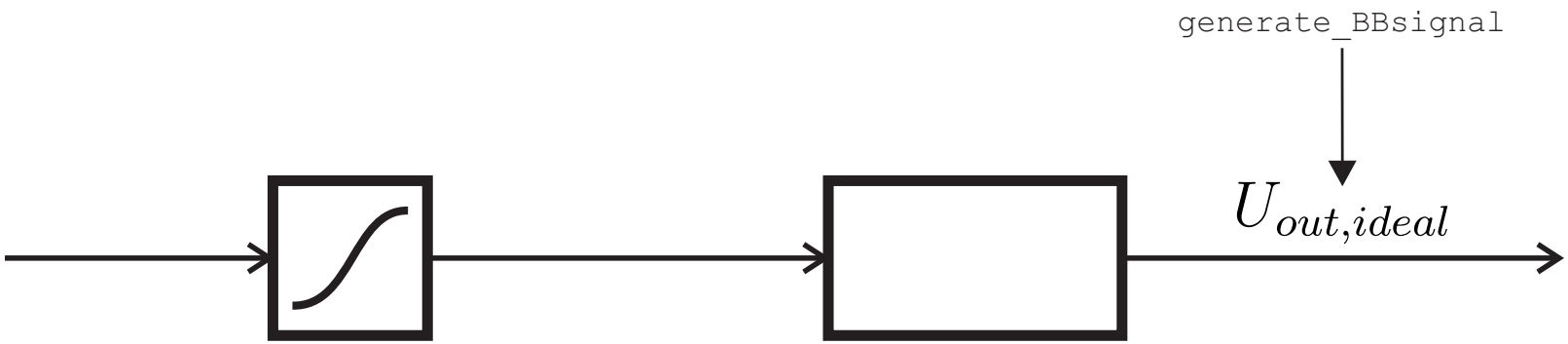


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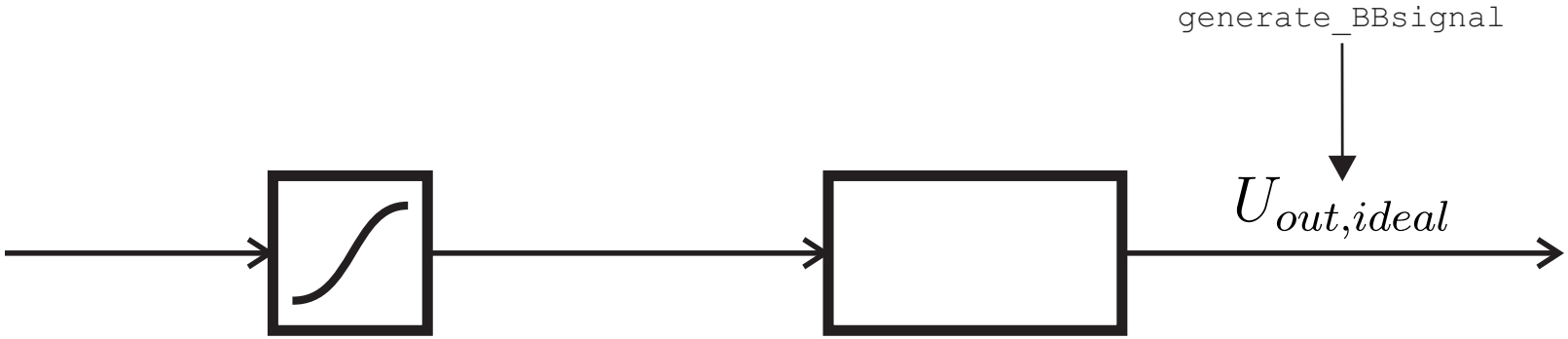


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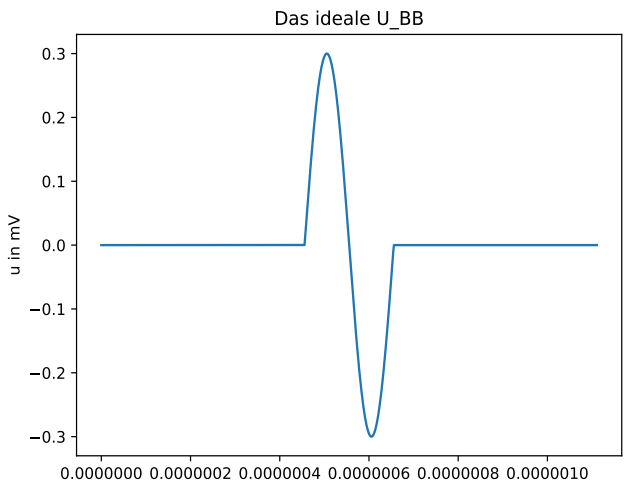

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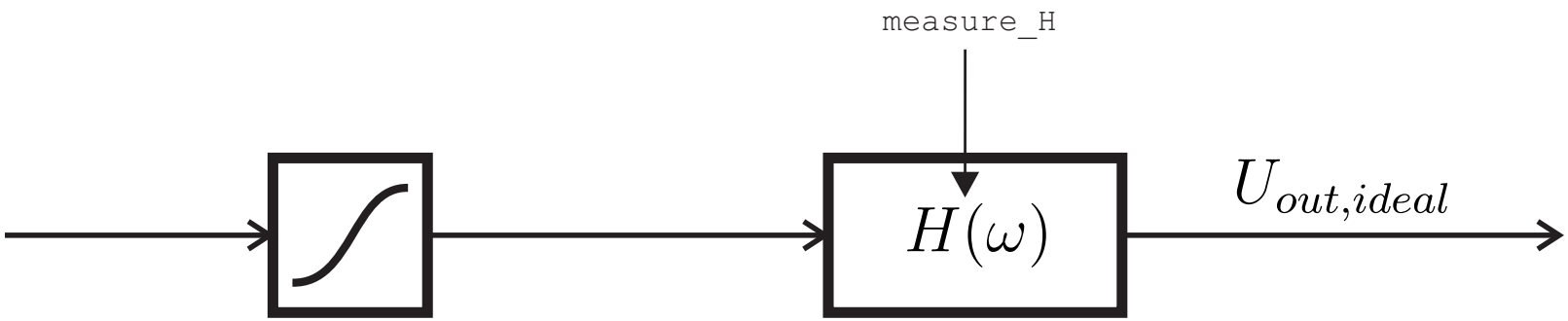


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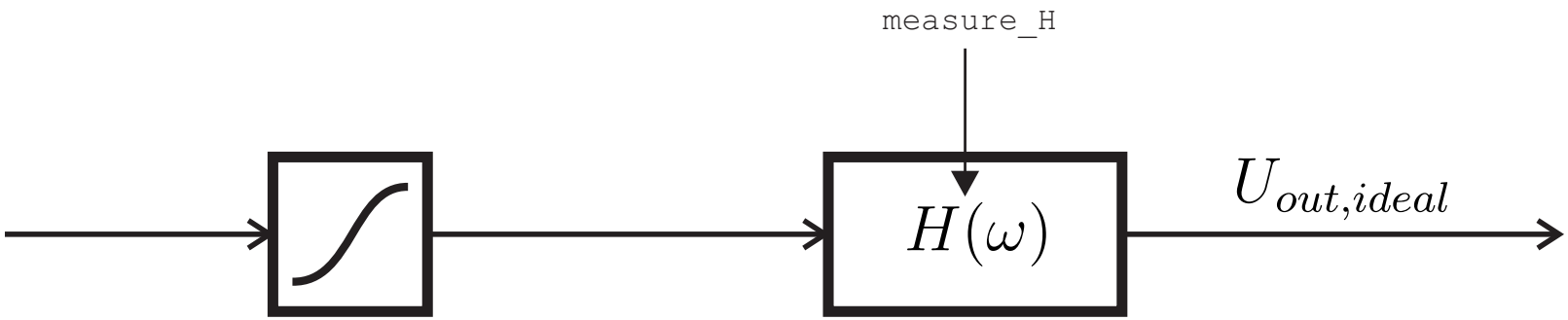


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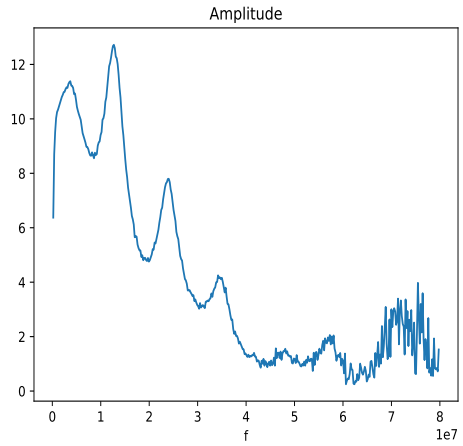
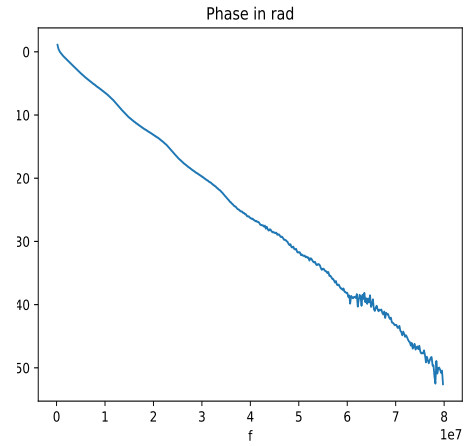
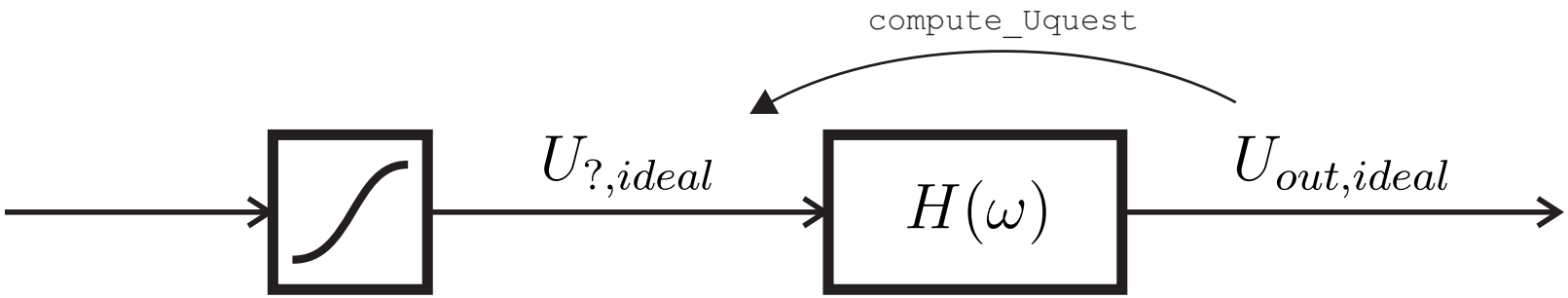


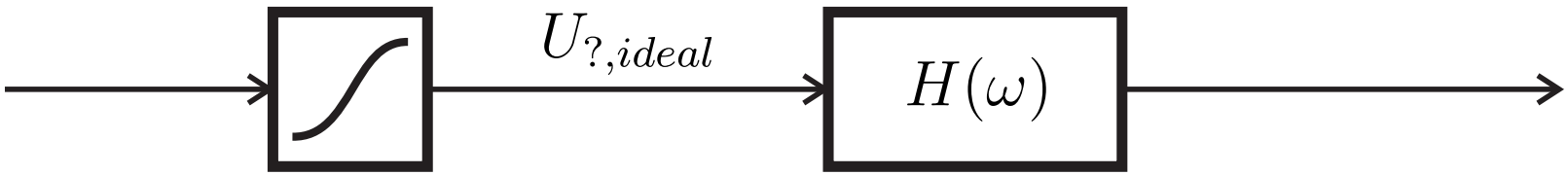


Code: Evaluierung




```
1 Uout_ideal = generate_BBsignal ( fq_rep, fq_bb, vpp )
2 H = measure_H ( )
3 Uquest_ideal = compute_Uquest ( Uout_ideal, H )
```

Code: Evaluierung

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1 Uout_ideal = generate_BBsignal ( fq_rep, fq_bb, vpp )
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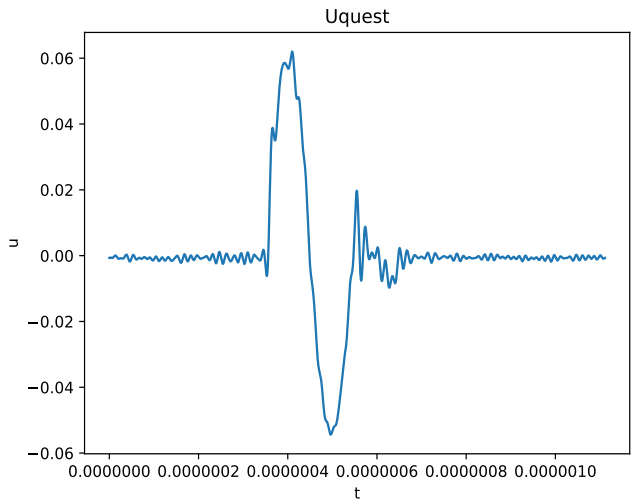
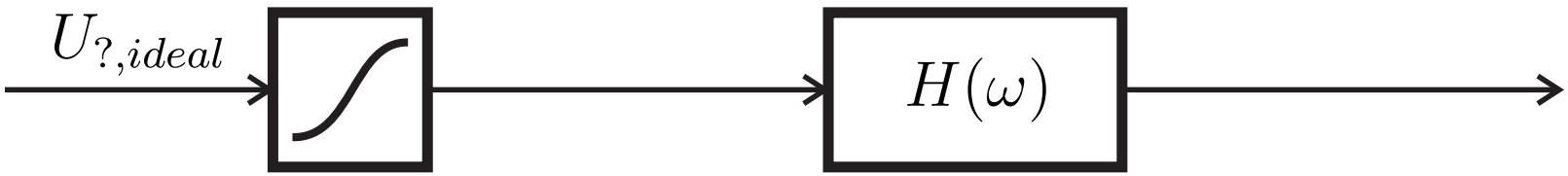


Code: Evaluierung

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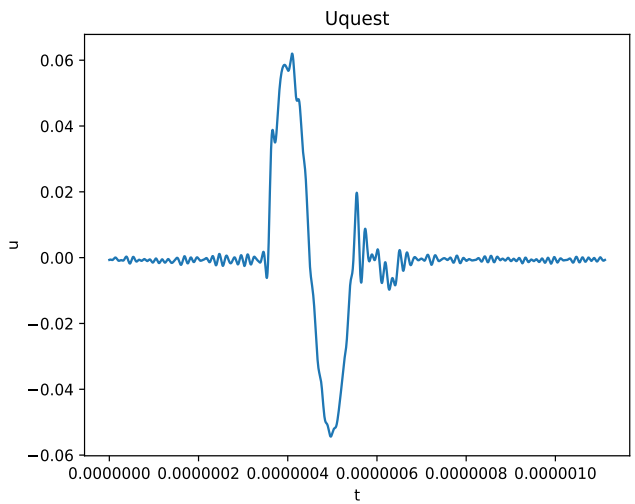
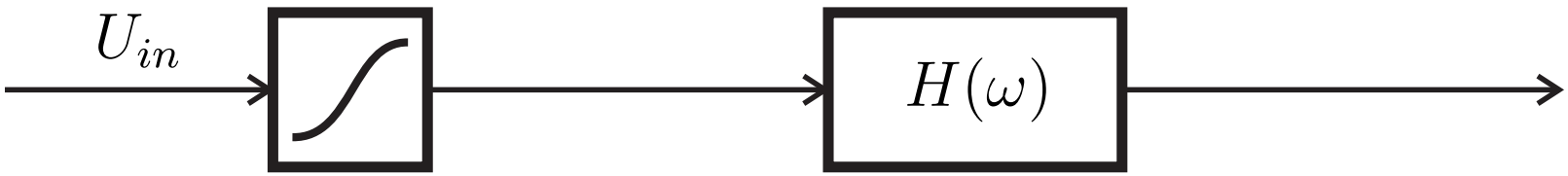
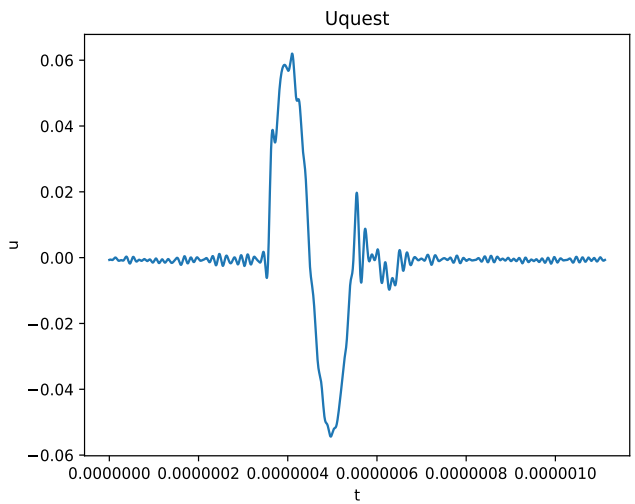


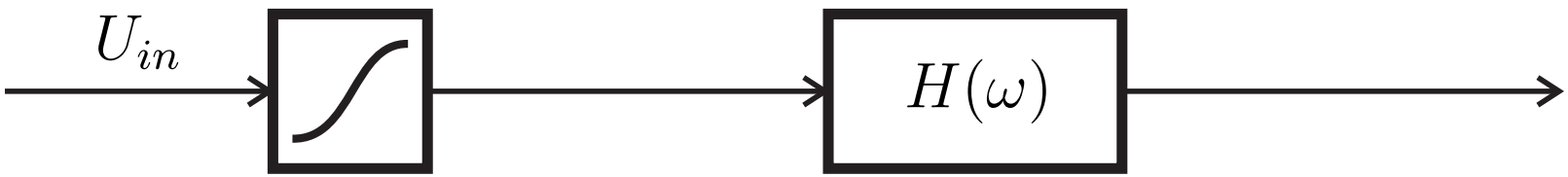
Code: Evaluierung




```
1 Uout_ideal = generate_BBsignal ( fq_rep, fq_bb, vpp )
2 H = measure_H ( )
3 Uquest_ideal = compute_Uquest ( Uout_ideal, H )
4 Uin = Uquest_ideal
```



Code: Evaluierung

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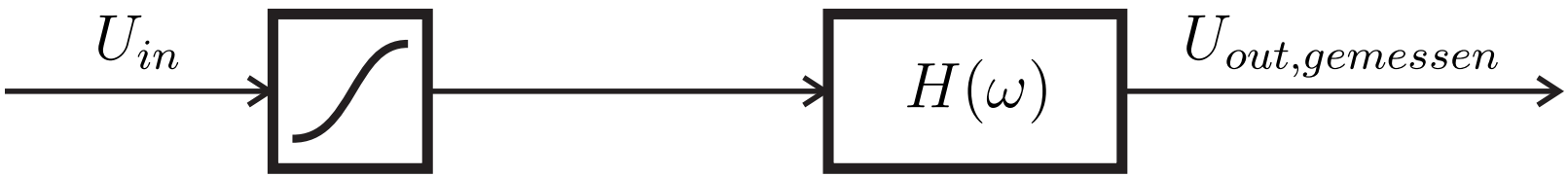
1 Uout_ideal = generate_BBsignal ( fq_rep, fq_bb, vpp )
2 H = measure_H ( )
3 Uquest_ideal = compute_Uquest ( Uout_ideal, H )
4 Uin = Uquest_ideal
5 Uout_measured = measure_Uout ( Uin )
```

Code: Evaluierung

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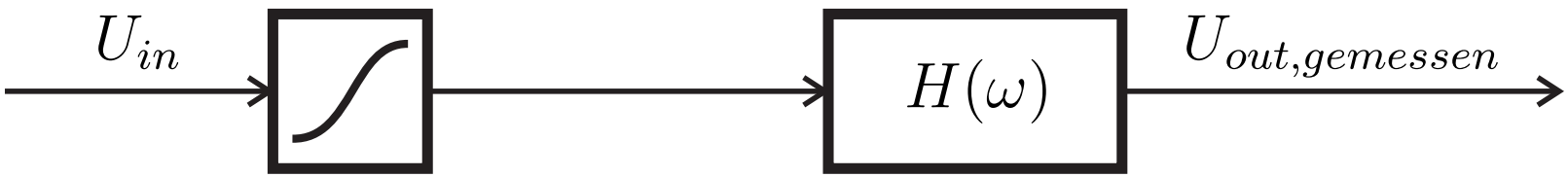
Code: Evaluierung

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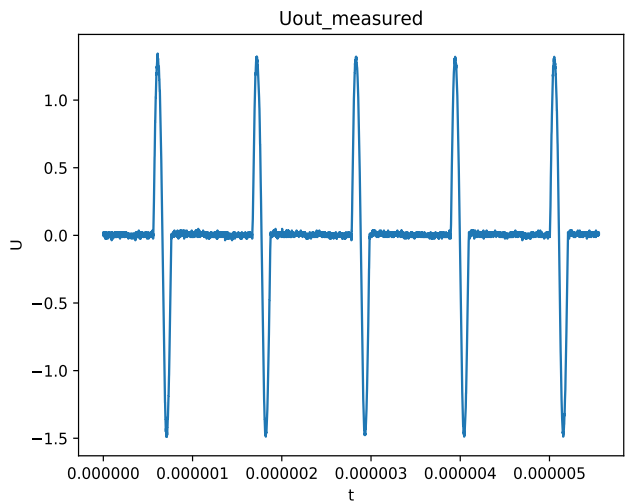
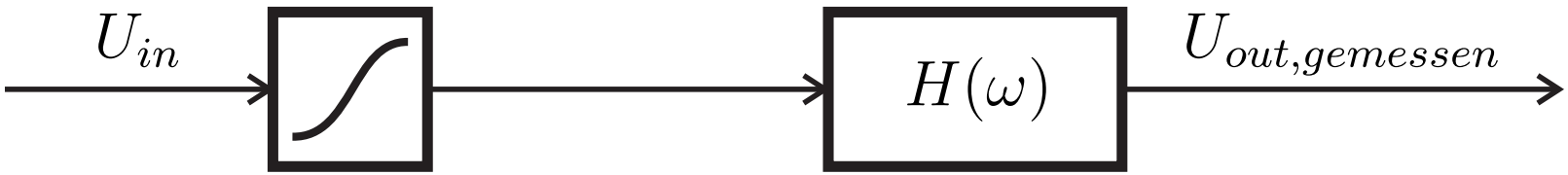


Code: Evaluierung

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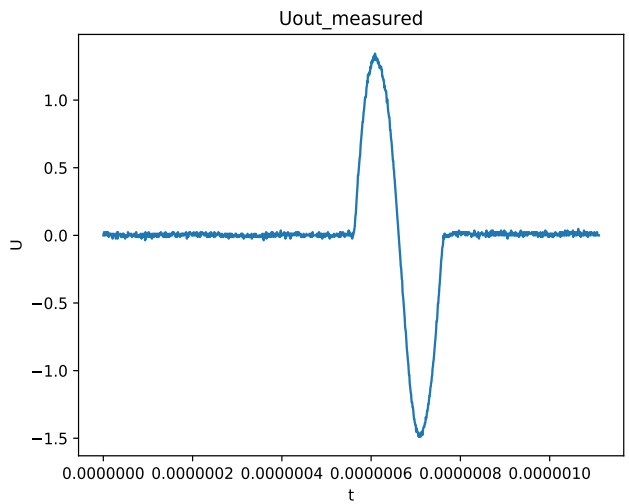
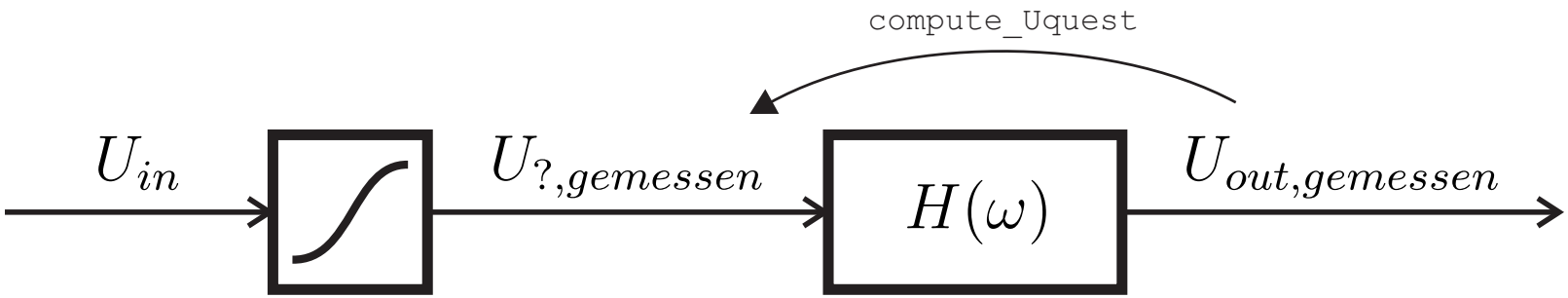


Code: Evaluierung

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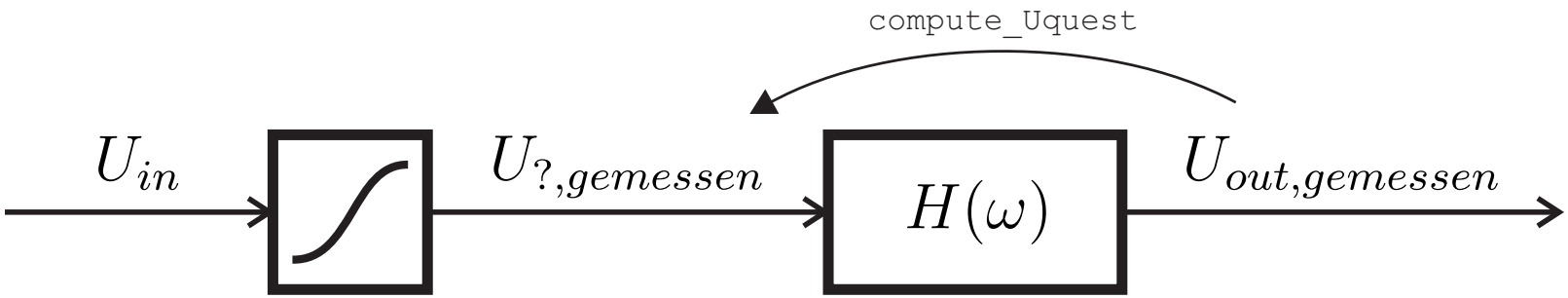
1 Uout_ideal = generate_BBsignal ( fq_rep, fq_bb, vpp )
2 H = measure_H ( )
3 Uquest_ideal = compute_Uquest ( Uout_ideal, H )
4 Uin = Uquest_ideal
5 Uout_measured = measure_Uout ( Uin )
6 Uquest_measured = compute_Uquest ( Uout_measured, H )
```

Code: Evaluierung

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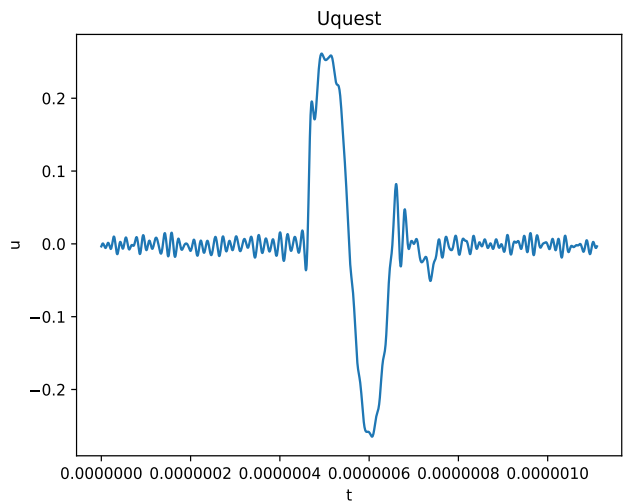
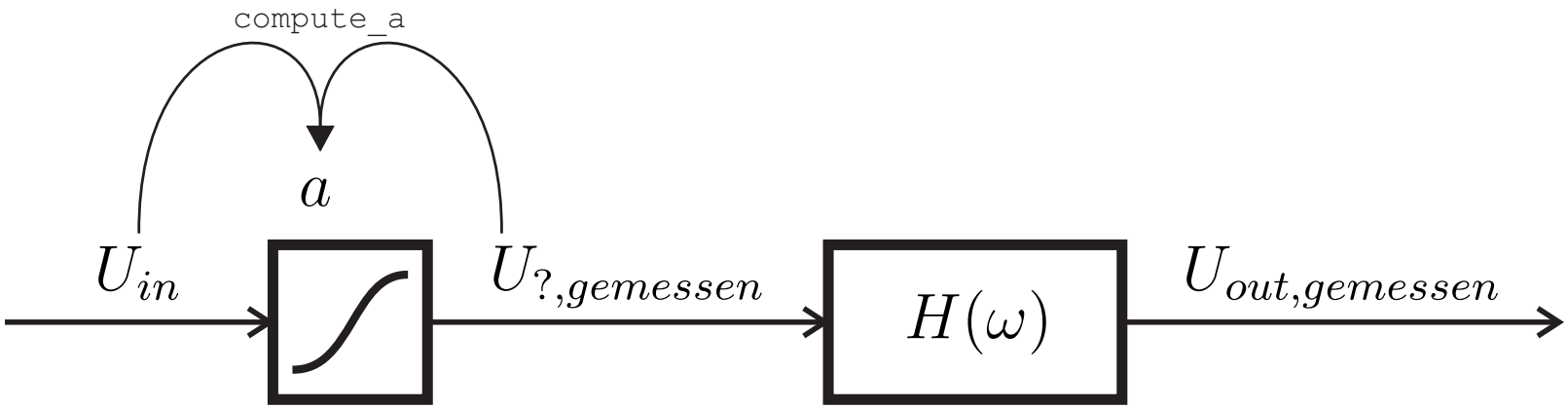
4 Uin = Uquest_ideal
5 Uout_measured = measure_Uout ( Uin )
6 Uquest_measured = compute_Uquest ( Uout_measured, H )
```



Code: Evaluierung

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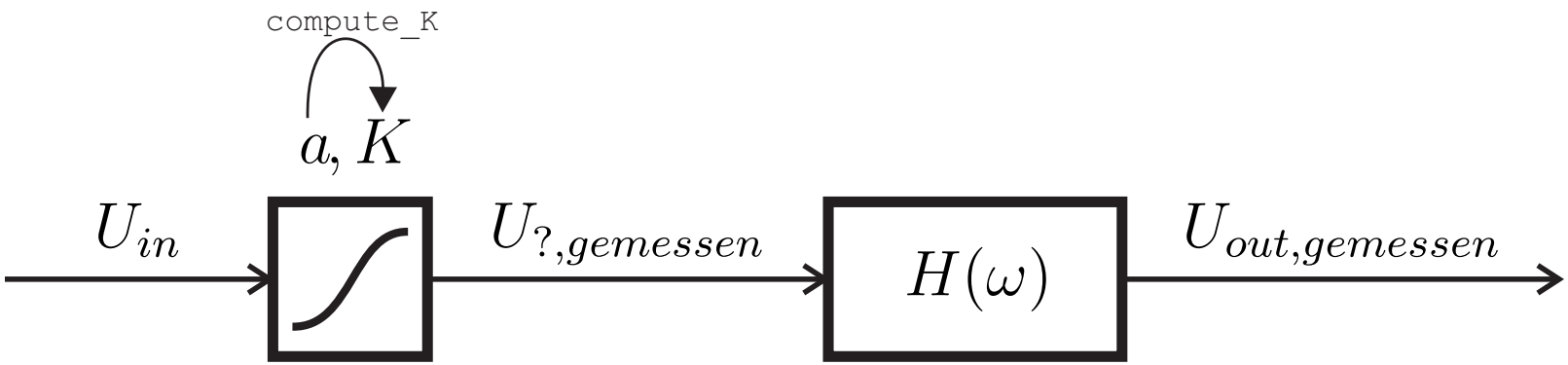
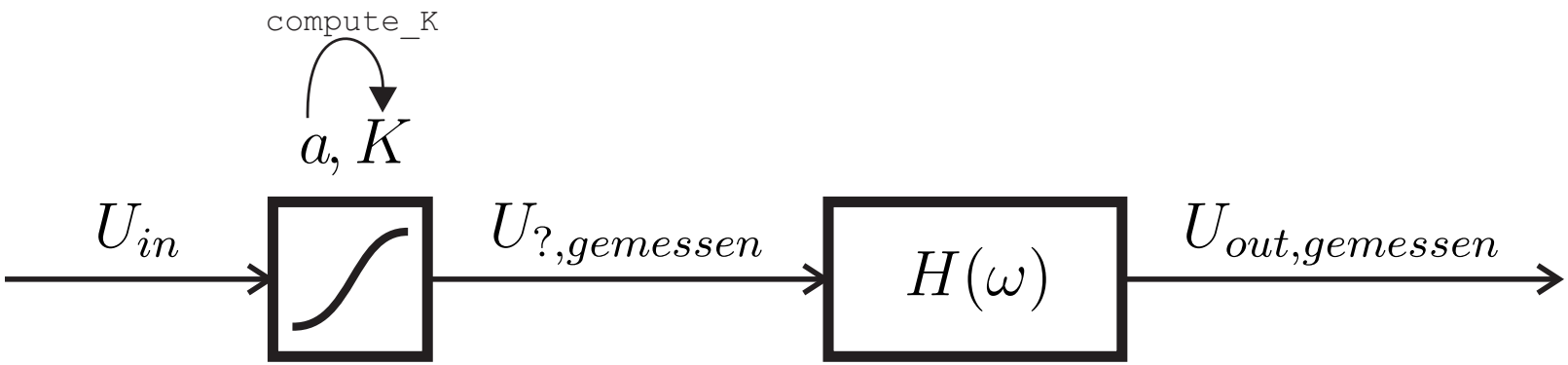
1 Uout_ideal = generate_BBsignal ( fq_rep, fq_bb, vpp )
2 H = measure_H ( )
3 Uquest_ideal = compute_Uquest ( Uout_ideal, H )
4 Uin = Uquest_ideal
5 Uout_measured = measure_Uout ( Uin )
6 Uquest_measured = compute_Uquest ( Uout_measured, H )
7 a = compute_a ( Uin, Uquest_measured, N )
```

Code: Evaluierung




```
1 Uout_ideal = generate_BBsignal ( fq_rep, fq_bb, vpp )
2 H = measure_H ( )
3 Uquest_ideal = compute_Uquest ( Uout_ideal, H )
4 Uin = Uquest_ideal
5 Uout_measured = measure_Uout ( Uin )
6 Uquest_measured = compute_Uquest ( Uout_measured, H )
7 a = compute_a ( Uin, Uquest_measured, N )
8 K = compute_K ( a )
```

Code: Evaluierung

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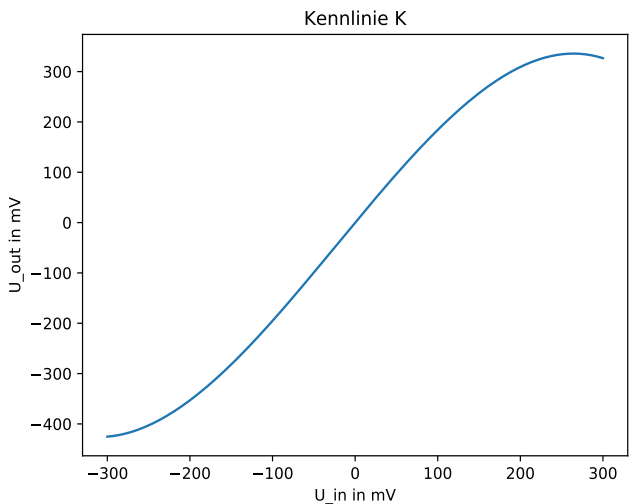
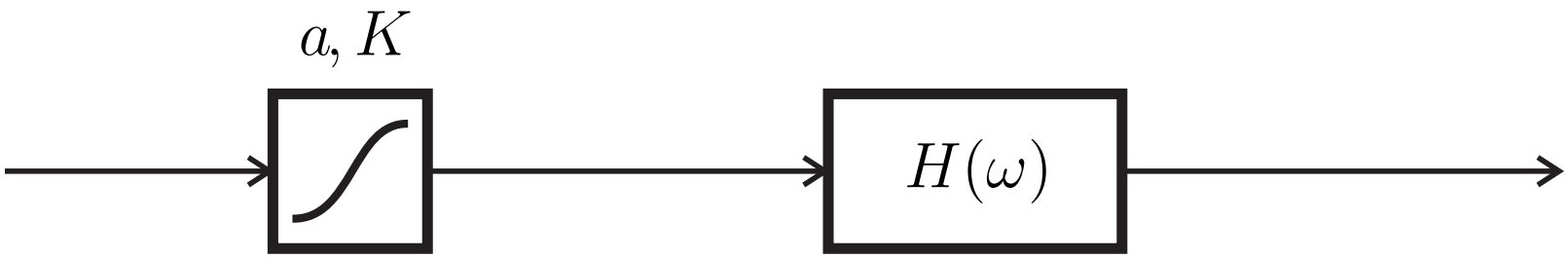
8 K = compute_K ( a )
```



Code: Evaluierung

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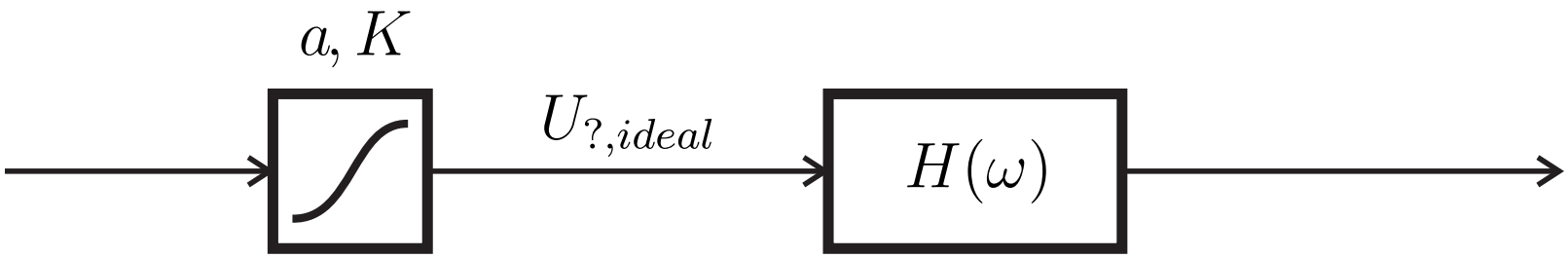
H = measure_H ( )
Uquest_ideal = compute_Uquest ( Uout_ideal, H )
Uin = Uquest_ideal
Uout_measured = measure_Uout ( Uin )
Uquest_measured = compute_Uquest ( Uout_measured, H )
a = compute_a ( Uin, Uquest_measured, N )
K = compute_K ( a )
```

Code: Evaluierung

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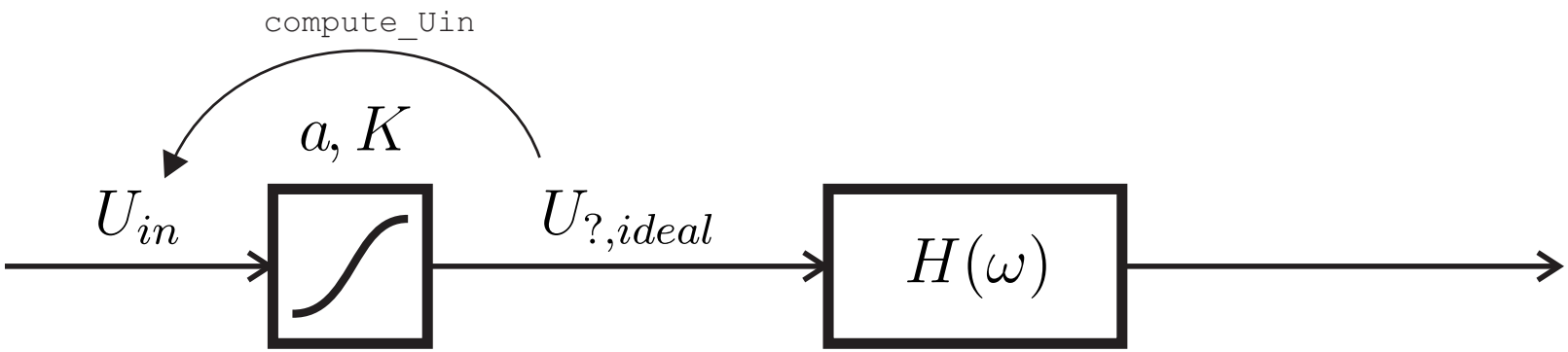
Uout_ideal = generate_BBsignal ( fq_rep, fq_bb, vpp )
H = measure_H ( )
Uquest_ideal = compute_Uquest ( Uout_ideal, H )
Uin = Uquest_ideal
Uout_measured = measure_Uout ( Uin )
Uquest_measured = compute_Uquest ( Uout_measured, H )
a = compute_a ( Uin, Uquest_measured, N )
K = compute_K ( a )
```

Code: Evaluierung

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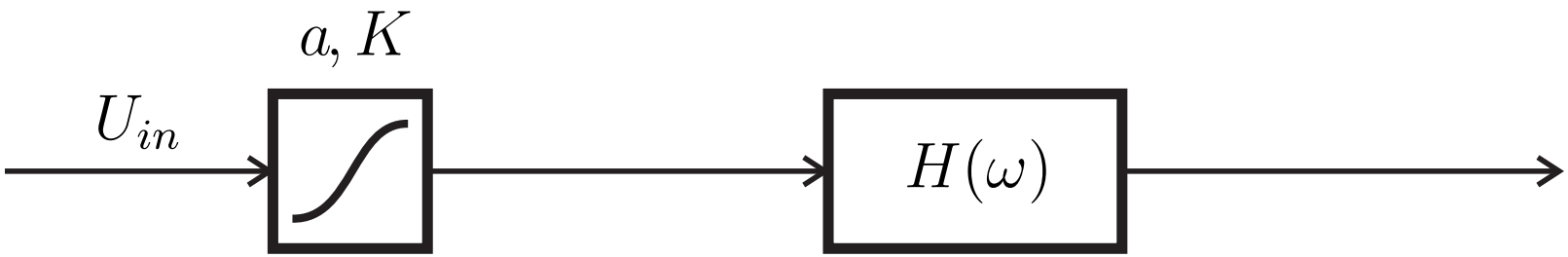
Uquest_ideal = compute_Uquest ( Uout_ideal, H )
Uin = Uquest_ideal
Uout_measured = measure_Uout ( Uin )
Uquest_measured = compute_Uquest ( Uout_measured, H )
a = compute_a ( Uin, Uquest_measured, N )
K = compute_K ( a )
Uin = compute_Uin ( Uquest_ideal, K )
```

Code: Evaluierung

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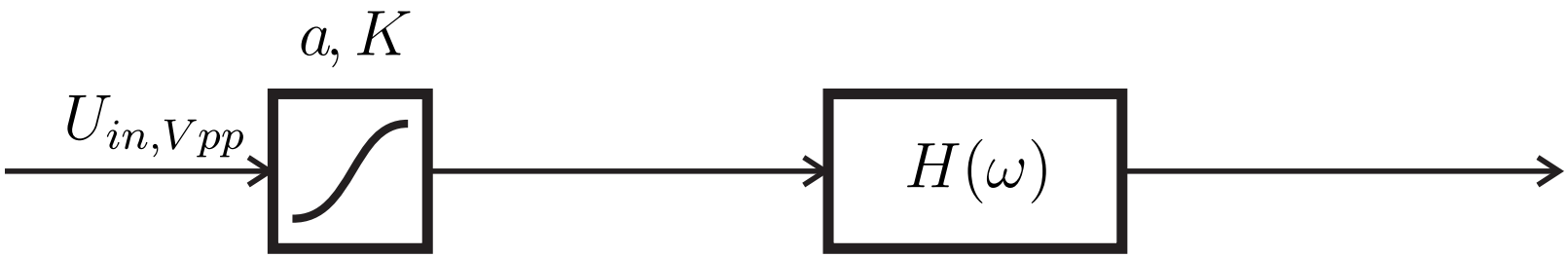
Uin = Uquest_ideal
Uout_measured = measure_Uout ( Uin )
Uquest_measured = compute_Uquest ( Uout_measured, H )
a = compute_a ( Uin, Uquest_measured, N )
K = compute_K ( a )
Uin = compute_Uin ( Uquest_ideal, K )
```

Code: Evaluierung

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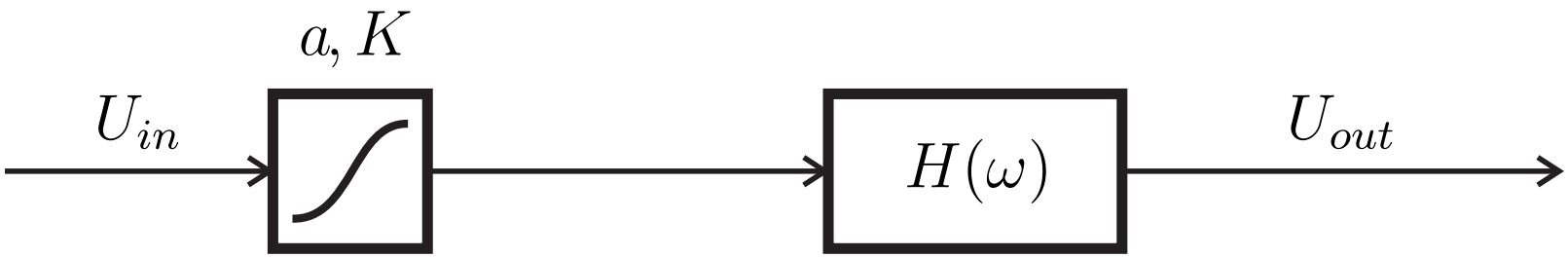
H = measure_H ( )
Uquest_ideal = compute_Uquest ( Uout_ideal, H )
Uin = Uquest_ideal
Uout_measured = measure_Uout ( Uin )
Uquest_measured = compute_Uquest ( Uout_measured, H )
a = compute_a ( Uin, Uquest_measured, N )
K = compute_K ( a )
Uin = compute_Uin ( Uquest_ideal, K )
Uin = set_Vpp ( Uin, Vpp )
```

Code: Evaluierung

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Uquest_ideal = compute_Uquest ( Uout_ideal, H )
Uin = Uquest_ideal
Uout_measured = measure_Uout ( Uin )
Uquest_measured = compute_Uquest ( Uout_measured, H )
a = compute_a ( Uin, Uquest_measured, N )
K = compute_K ( a )
Uin = compute_Uin ( Uquest_ideal, K )
Uin = set_Vpp ( Uin, Vpp )
Uout = measure_Uout ( Uin )
```

Ausblick

- Iterative Optimierung der linearen Übertragungsfunktion mittels Auswertung der erwarteten und gemessenen Ausgangssignale U_{out}:

$$\underline{H}^{\text{neu}}(\omega) = \underline{H}^{\text{alt}}(\omega) \cdot \frac{\underline{U}_{out,\text{ideal}}(\omega)}{\underline{U}_{out,\text{mess}}(\omega)} \cdot \sigma_H$$

  mit σ_H als Schrittweite der jeweiligen Iteration

- Optimierung der nichtlinearen Kennlinie mittels Vergleich der Differenz der erwarteten und gemessenen Spannungssignale U_{quest} und der Faktoren a der polynomialen Kennlinie:

$$\Delta U_? = U_{?,\text{mess}} - U_{?,\text{berechnet}} = \sum_n \tilde{a}_n U_{in}^n \qquad a_n^{\text{neu}} = a_n^{\text{alt}} + \sigma_a \cdot \tilde{a}_n$$

  mit σ_a als Schrittweite der jeweiligen Iteration