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| **Fourir & Laplace FS2022 Tim Gehrig** | | | | | | | | | | | | | | | | | | | | | | | |
| **Definitionen / Grundlagen** | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | |  | | | | | |  | | | | | | | | Zeitbereich | | | | |
|  | | | | |  | | | | | |  | | | | | | | | Bildbereich / (Laplace) | | | | |
|  | | | | |  | | | | | |  | | | | | | | | Frequenzbereich /(Fourir) | | | | |
| Delta |  | | |  | | | | | | Sprungfunktion  σ(t) | | | |  | | | Signum  sgn(t) | | | | | |  | | |
| Euler |  | | | | | | | | | |  | | | | | | | | | | | | |
| **Systemfunktionen und Schaltungen** | | | | | | | | | | | | | | | | | | | | | | | |
|  | kausale (reale) Funktion  Heisst ab 0 von 0 verschieden | | | | | | | | | Frequenz bleibt erhalten | | | | | |  | | | | | | | |
| Übertragungs- funktion |  | | | | | | | | | Wirkung des LTI-Systems auf ein Eingangssignal (Bildbereich) ; ˆ= Impulsantwort ; ˆ= Kehrwert des Charakteristischen Polynoms der Laplacetransformierten DGL des LTI-Systems | | | | | | | | | | | | | |
| Gewichts-  Funktion |  | | | | | | | | | Wirkung des LTI-Systems auf ein Eingangssignal (Zeitbereich) | | | | | | | | | | | | | |
| Impulsantwort |  | | | | | | | | | Systemantwort auf einen Dirac-Stoss δ(t); 1(s) = L[δ(t)] | | | | | | | | | | | | | |
| Sprungantwort |  | | | | | | | | | Systemantwort auf die Einheitssprungfunktion σ(t) = u(t); 1 s = L[σ(t)] | | | | | | | | | | | | | |
| Serieschaltung von n LTI-Systemen | | | | | |  | | | | | | | | | |  | | | | | | | |
| Parallelschaltung von zwei LTI-Systemen | | | | | |  | | | | | | | | | |  | | | | | | | |
| Rückkopplung mit G2 | | | | | |  | | | | | | | | | |  | | | | | | | |
| Pol-Nullstellen-Plan  BIBO-stabil | | | | | | 1 | | | | | | | | | | | | | | | 1. G(s) ausrechnen 2. Schauen ob Nenner / Zähler Nullstellen hat 3. Nullstelle:  * Kein Realteil * Kein Immaginärteil | | |
| **Frequenzgang** | | | | | | | | | | | | | | | | | | | | | | | |
| Anregung |  | | | | | | | | | | | |  | | | | | | | | | | |
| Anregung eines  Signal  Die Systemantwort | Umwandeln in sin / cos | | | | | | | | | | | | Signal in von sin cos in e Funktion umwandeln  e Potenzen in Frequenzgang ausrechnen  machen und Ausrechnen | | | | | | | | | | |
| Frequenzgang |  | | | | | | | | | | | | Antwort eines Systems auf ein sinusförmiges Eingangssignal= stationärer Teil der Impulsantwort ; = Kehrwert des Char. Polynoms der fouriertransformierten DGL des LTI-Systems | | | | | | | | | | |
| Amplituden  Gang |  | | | | | | | | | | | | Amplitudenveränderung des Frequenzgangs | | | | | | | | | | |
| Phasengang  arg() |  | | | | | | | | | | | | Phasenveränderung des Frequenzgangs | | | | | | | | | | |
| Beispiel |  | | | | | | | | | | | | f(t) mit Euler in e umformen  und ausmultiplizieren | | | | | | | | | | |
| Amplituden-  Spektrum |  | | | | | |  | | | | | | | | | | | | | | Vorfaktor herauslesen  Die Amplitude immer positiv | | |
| Phasen-  Spektrum |  | | | | | |  | | | | | | | | | | | | | | Vorfaktor herauslesen | | |
| **Fourirreihe** | | | | | | | | | | | | | | | | | | | | | | | |
| Fourirreihe |  | | | | | | | | | | | |  | | | | | | | | | | |
| Faktoren |  | | | | | | | | | | | |  | | | | | | | | | | |
| Zusammenhänge |  | | | | | | | | | | | |  | | | | | | | | | | |
| **Fourirtransformation** | | | | | | | | | | | | | | | | | | | | | | | |
| Transformation | 1. Integrale aufstellen 2. Integrale lösen 3. Alles zusammenrechnen | | | | | | | |  | | | | | | | | | | | | | | |
| Rück-transformation |  | | | | | | | | | | | |  | | | | | | | | | | |
| Spektraldichte  -funktion |  | | | | | | | | | | | |  | | | | | | | | | | |
| Amplituden  -dichte |  | | | | | | | | | | | |  | | | | | | | | | | |
| Phasendichte |  | | | | | | | | | | | | Nullstellen ausrechnen  Höhe ausrechnen  Diagramm zeichnen (Wechsel and den Nullstellen) | | | | | | | | | | |
| **Diskrete Fourier-Transformation (DFT)** | | | | | | | | | | | | | | | | | | | | | | | |
| DFT |  | | | | | | | | | | | | N: Anzahl Abtastwerte in einer Periode  Abtastwerte des Signal  Argument von | | | | | | | | | | |
| inverse DFT |  | | | | | | | | | | | |  | | | | | | | | | | |
| Rück-transformation |  | | | | | | | | | | | | Ergibt kontinuierliche Approximation von f(t) | | | | | | | | | | |
| Abstasttheorem | Abtastrate mind. 2x in der Periode | | | | | | | Funktion kann eindeutig rekonstruiert werden | | | | | | | | | | | | | | | |
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| Laplace-  transformation |  | | | | | | | | | | | |  | | | | | | | | | | |
| Rück-transformation |  | | | | | | | | | | | | Besser Tabelle verwenden | | | | | | | | | | |
| **Z-Transformation** | | | | | | | | | | | | | | | | | | | | | | | |
| Von einer kausalen Funktion f(t) seien nur diskrete Abtastwerte fk(k · T) mit k ∈ N und T > 0 gegeben. Um trotzdem die Vorteile der Laplace-Transformation nutzen zu können, wurde die Z-Transformation eingeführt. | | | | | | | | | | | | | | | | | | | | | | | |
| Darstellung der Abtastung |  | | | | | | | | | | | | | | | | | | | | | | |
| **Diagramme** | | | | | | | | | | | | | | | | | | | | | | | |
| Bode-Diagramm | | | | | | | | | | | Nyquist-Diagramm | | | | | | | | | | | | |
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| **Diffrenztialgleichungen** | | | | | | | | | | | | | | | | | | | | | | | |
| Diffrenztial  Frequenzgang |  | | | | | | | | | | | | Charateristisches Polynom bilden  Ableitung = Exponent & Vorfaktor = Vorfaktor | | | | | | | | | | |
| Diffrenzial |  | | | | | | | | | | | | | | | | | Diffrentialgleichung aufstellen  L-Transformieren + Einsetzen  Nach Y(s) Auflösen ( F(s) = Y(s) )  Rücktransformieren mit Tabelle  Herausschreiben | | | | | |
| Differentiation  Formeln |  | | | | | | | | | | | | | | | | | | | | | | |
| Störfunktion |  | | | | | | | | | | | | | | | | | | |  | | | |
| **Faltungsprodukt / Systemantwort** | | | | | | | | | | | | | | | | | | | | | | | |
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| Faltung /  Impulsantwort  y(t) | Meist g(t) & f(t) schon richtig aber nicht immer | | | | | | | | |  | | | | | | | | | | | | | |
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| **Grenzen** | | | Oben :  Horizontale Grenze von | | | | | | | | | **Grenze:** | | | | | | | | | | |
| Unten:  Horizontale Grenze von 0 bis 1  **Grenze:** | | | | | | | | |
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| **Tabelle Euler** | | | | | | | | | | | | | | | | | | | | | | | |
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| **Integrale** | | | | | | | | | | | **Ableitungen** | | | | | | | | | | | | |
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| **Fourir Laplace** | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | Im Fourirbereich | | | | | | | | | Im Laplacebereich | | | | | | | | | | | | |
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| Transformation | | |  | | | | | | | | |  | | | | | | | | | | | | |
| Rücktransf | | |  | | | | | | | | |  | | | | | | | | | | | | |
| Linearität | | |  | | | | | | | | |  | | | | | | | | | | | | |
| Verschiebung | | |  | | | | | | | | |  | | | | | | | | | | | | |
| Modulation / Dämpfung | | |  | | | | | | | | |  | | | | | | | | | | | | |
| Streckung | | |  | | | | | | | | |  | | | | | | | | | | | | |
| Differentiation  Für Differential  Gleichungen | | |  | | | | | | | | |  | | | | | | | | | | | | |
| Integration | | |  | | | | | | | | |  | | | | | | | | | | | | |
| Faltungsprodukt | | |  | | | | | | | | |  | | | | | | | | | | | | |

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| **Laplace Tabellen**  **Partialbruchzerlegung nicht vergessen** | | | |
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| **Goniometrie-Formeln** | | | |
| Additionstheoreme | | | |
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| Doppelte und halbe Winkel | | | |
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| Summe zu Produkt | | | |
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| Produkt zu Summe | | | |
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| **Integration** | | | |
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| **Partialbruchzerlegung** | | | |
| Gleichungssystem lösen | | | |