Gliederung zur Vorlesung FM2

- FM 2 - Flugdynamik & Flugregelung
- Inhalt der Vorlesung
- ----------
- **1 Aircraft Flight Control - Introduction**

- **2 The Equations of Motion of an Aircraft**
- ----------
- 2.1 Overview
- 2.2 Background Information
  - Reference Frames
  - Summary of Nomenclature
  - Analogy: Translational and Rotational Motion
  - The Equation of Motion of a Rigid Body
  - The Inertia Matrix
- 2.3 Translational Motion
  - Forces due to Gravity
  - Angular Velocities and Euler Angle Rates
  - Axis Transformation
  - Linearization and Combination of Terms
- 2.4 Complete Linearized Equation of Motion
  - Velocity Components along Body Axis
- 2.5 Equation of Motion in Stability Axis System
- 2.6 Equation of Motion for Steady Manoeuvring Flight Conditions
- 2.7 Additional Motion Variables
- 2.8 State and Output Equation
  - State Equation for Longitudinal Motion
  - State Equation for Lateral Motion
- 2.10 Stability Derivatives
- 2.11 Thrust Effects
- 2.9 Obtaining Transfer Functions

- **3 Aircraft Stability and Dynamics**
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- Overview
- 3.1 Introduction
- >>> Background Information
  - Aircraft Response to Controls
  - Inverse of a Matrix - Cramer's Rule
- 3.4 Transfer Functions - Longitudinal Motion
- 3.8 Transfer Functions - Lateral Motion
- >>> Background Information
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  - The s-Plane
- 3.2 Longitudinal Stability
- 3.3 Static Stability
- >>> Short Period and Phugoid Approximation
- 3.5 Transfer Functions - Short Period Approximation
- 3.6 Transfer Functions - Phugoid Approximation
- 3.7 Lateral Stability
- 3.9 3D Approximation
  - 3D Dutch Roll Approximation
  - 3D Spiral and Roll Subsidence Approximation
- 3.10 2D Approximation
  - 2D Dutch Roll Approximation
- 3.11 1D Approximation
- >>> Commentary on Approximate Lateral Equations
- 3.12 Uncoupling Roll and Yaw

4 A Note on Structural Flexibility (McLean)

- **5 Disturbances Affecting Aircraft Motion (Gusts)**
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- Wind Shear and Microburst
- Vertical Wind Gradient
- The Effects of Gusts on Aircraft Motion
- State Equation Including Gust Inputs
- Gust-Input Transfer Functions

6 Flying and Handling Qualities

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Specifications
Flying Qualities for the Short Period Response
Time to Double - Time to Half
Time to Double for a Second Order System

7 Control Theory

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7.2 Feedback
7.3 Control System Design
7.4 Pole Placement
7.5 Root Loci
7.6 System Type and Rank --- Frequency Response
7.7 Calculating F(jw)
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7.9 Polar Plots
7.10 Nichols Plots
7.11 Stability Criteria
- General Remarks
- Routh Stability Criterion
- Gain and Phase Margin
- Nyquist Stability Criterion

Appendix: Control System Modelling

- **8 Aircraft Control**
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- 8-9 Stability Augmentation Systems (SAS)
  - Pitch Rate SAS
  - Control Law
  - Additional Feedback Terms
  - Yaw Damper
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  - Spiral Mode Stabilization
- 8-10 Attitude Control Systems
  - Pitch Attitude Control System
  - Roll Angle Control System
- 8-11 Flight Path Control Systems
- Summary
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- Note: Numbering is related to McLean's book

9 Mathematical Models of Human Pilots (McLean)

Appendix: Stability and Control Derivatives

Übungen zu MATLAB/Simulink werden passend zum Unterricht der "Flugdynamik und Regelung" eingeschoben.