

Artificial Intelligence Engineering Systems – Signals, systems and control

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Offered by	Department of Electrical Engineering
Language	English
Primarily interesting for	Coherent package that is most relevant for students with a background in Computer Science, Data Science, Psychology and Technology, or Industrial Engineering who aim to enter the MSc program Artificial Intelligence Engineering Systems.
Prerequisites	5ESE0: assumed pre-knowledge 2WBBO & 5EIA0. 5ESB0: assumed pre-knowledge 2DE20, 5ESE0 & 4DA00. 5ESD0: assumed pre-knowledge 5ESE0 & 5ESB0. 4DB00: assumed pre-knowledge 4DA00, 4CB00 & 0LAB0.
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Content and composition

This coherent package is focusing on signals, signal processing techniques, mathematical models for the description of linear and time-invariant dynamical systems and provides a number of elementary techniques for their control. The package offers tools for the representation of signals, for the different representations and for the analysis of dynamical systems and presents a number of techniques for the synthesis of controllers that effect stability, behavior and performance of systems.

The package connects to the entrance level on signals, systems and control of the MSc program *Artificial Intelligence Engineering Systems* (AIES) and is recommended for bachelors students that consider doing a masters in AIES and lack relevant background on signals, systems and control. There are three (3) coherent packages preparing for the MSc program AIES. Only one of these packages can be selected as coherent package in your Bachelor's degree program.

Course code	Course name	Level classification
5ESE0	Signal processing basics (Signals I)	1. introductory
5ESB0	Systems	1. introductory
5ESD0	Control systems	3. advanced
<u>or</u>	<u>or</u>	
4DB00	Dynamics and control of mechanical systems	2. deepening

Courses in the above table that are included in the major program for which you are registered cannot be taken as courses in this coherent package. If such a course is mandatory in this coherent package, this means that the package cannot be chosen. There is a preference to take the introductory courses *before* the deepening or advanced courses.

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Course description

5ESE0 Signal processing basics (Signals I)

Nowadays processing analog, or continuous-time, signals in the digital, discrete-time, domain is pervasive. This because of the fact that digital signal processing techniques are used in everything from digital photo cameras, digital television, mobile phones to automobiles and advanced medical imaging equipment. The course is organized in different modules around the topics: complex numbers and phasors, spectrum and fourier series, sampling and aliasing, finite impulse response filters, and frequency response.

5ESB0 Systems

Almost all engineering systems exhibit dynamic behaviour. In this course general tools for analysing and synthesizing dynamic systems described by differential equations are introduced. The basic principles of feedforward and feedback control are studied to show how the stability and performance of dynamic systems can be effectively influenced.

5ESD0 Control systems

Control systems are omnipresent in everyday use of technology. The basic principles of control of linear dynamic systems are explored, and design methods are treated for designing control systems to handle design specifications in terms of speed (bandwidth), stability and robustness under presence of disturbances and sensor noises. Achievements and limitations are being addressed and the theory is complemented with design assignments on laboratory setups.

4DB00 Dynamics and control of mechanical systems

This course is the first step into understanding how to model and control the dynamic response of mechanical systems like high-tech precision systems and automotive systems. To this end, the derivation of the equations of motion of Multi-Degree-Of-Freedom (MDOF) mechanical systems is presented; and their vibrating behavior is characterized. Classic control techniques to “shape” the response of mechanical systems to reference signals and disturbances are introduced.