

# Advanced Robot Control

## System decomposition

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**Presentation compiled for taking notes during lecture**



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- 1 System decomposition
  - Introduction
- 2 Decomposition
  - Types of decomposition
  - Functional decomposition
  - Hardware decomposition
  - Software decomposition
- 3 Quiz
  - Quiz



# System decomposition

What is system decomposition?



# Benefits of system decomposition

System decomposition can be compared to the modularity feature in design of an embedded system.



# Outline

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# How a system should be decomposed?

An embedded system can be decomposed in following aspects:

- functionality,
- hardware,
- software.



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# How a system should be decomposed?

Functional decomposition is an approach which consists of a few stages.





# Block decomposition (1/2)

After the process of functional decomposition a system can be divided into a few functional blocks. Each functional block can be treated e.g. as a task in RTOS whereas the data flows between block can be implemented using task synchronization mechanisms.



# Block decomposition (2/2)

- **Data acquisition**
- **Safety**
- **User interface**
- **Communication**
- **Data logger**
- **Control**
- **Execution**
- **Specialized block**
- **Governor**



# Example (1/1)

Figure: Road dryer [1]



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# Hardware architecture (1/1)

An embedded system can be divided into separate nodes. Each node of the system has to communicate with one or many nodes. Depending on the communication architecture between nodes of the system a categorization can be introduced.



# Network types (1/1)

- **Star**
- **Bus**
- **All to all**
- **Mesh**
- **Mixed**



# Node structure (1/1)

Hardware architecture can also be related to a single node in terms of modules attached to the main board.



# Examples (1/4)

Figure: All to all type of an architecture [1]





# Examples (2/4)

Figure: Single PCB



# Examples (3/4)

Figure: PCB with modules



# Examples (4/4)

Figure: Sandwich



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# Code organization (1/1)

Source code should be organized similarly to assumed functional decomposition.



# Code modularity (1/1)

Functionality present in functional blocks derived from a functional decomposition ought to be kept in separate files.



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# Quiz (1/1)

Calculate group number as the rest from dividing the Student ID number by 4.

## Example

Student ID number is 123456, thus the group is 0.

Take last 2 digits from Student ID number (56) and calculate the rest from dividing by 4 ( $56 \% 4 = 0$ ).

Write down your name, Student ID number and group.





# Literature (1/1)



W. Domski, A. Jabłoński, W. Rafajłowicz, A. Ratajczak, W. Tarnawski, and Z. Zajda.

*Mikroprocesorowo-webowy system maszyny drogowej TORGOS z silnikiem turbinowym, ze szczególnym uwzględnieniem automatyzacji i bezpieczeństwa eksploatacji. Wyniki badań określających zakres rozwiązań znacząco ulepszający system.*

, 2018.

