CONTRIBUTION TO FAULT DIAGNOSIS METHODS OF DYNAMIC SYSTEMS

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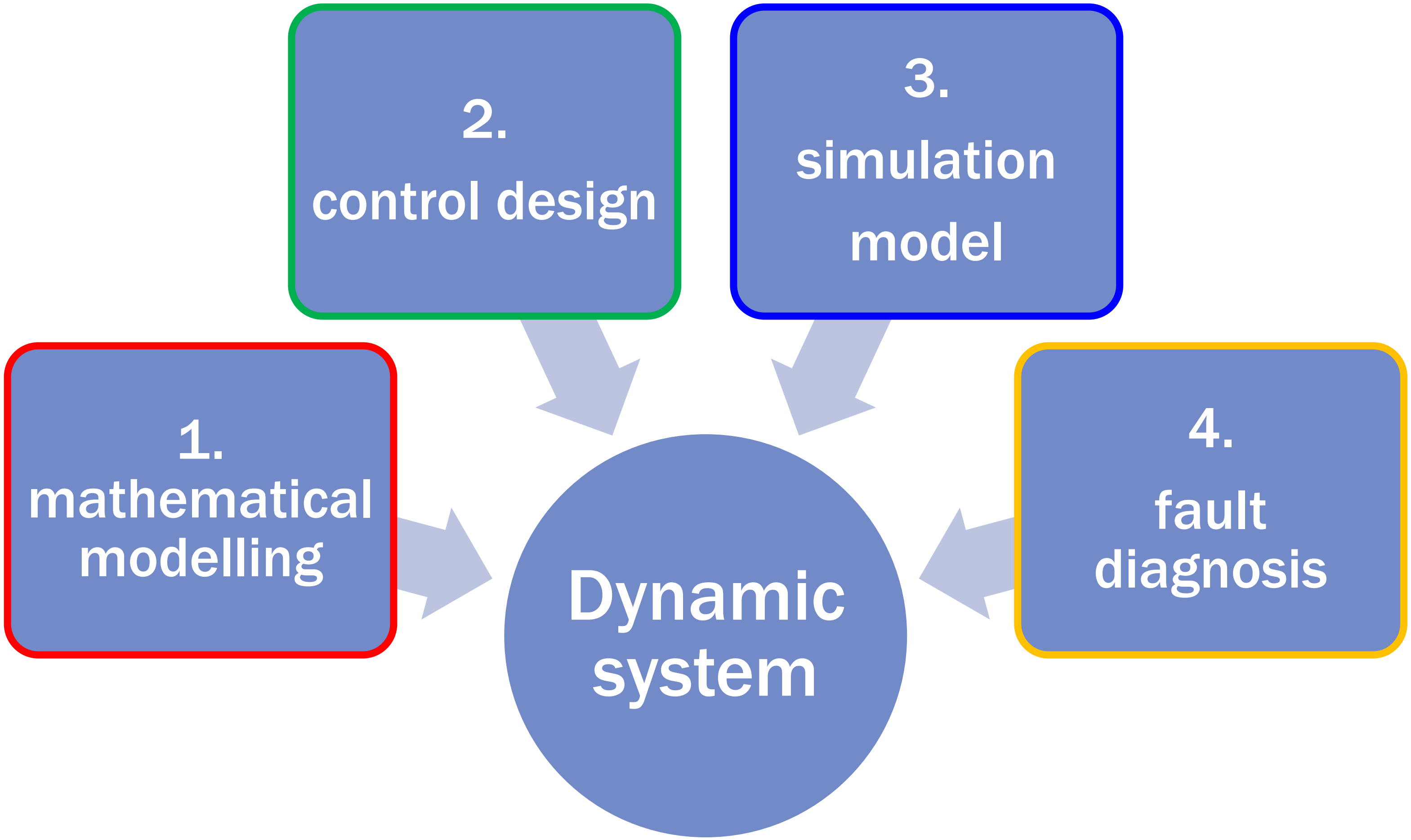
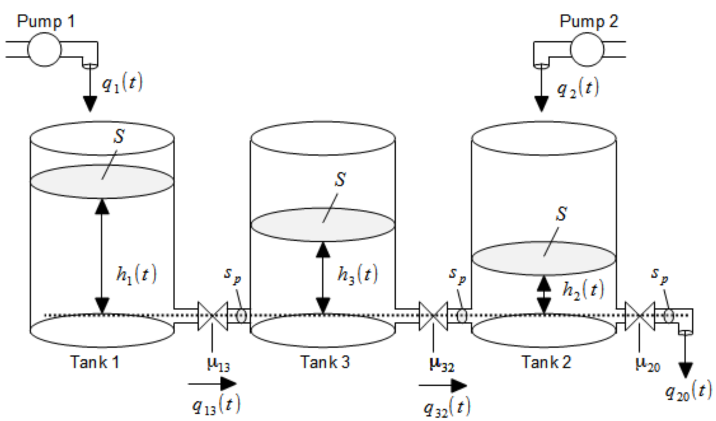
TOPICS OF INTEREST

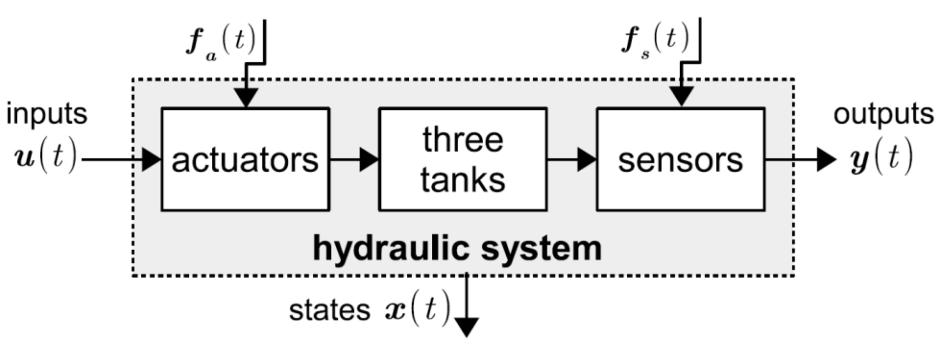


1. MODEL OF THE DYNAMIC SYSTEM

- model of the hydraulic system



$$\frac{dh_1(t)}{dt} = \frac{1}{S}\left(q_1(t) - q_{13}(t)\right),$$
$$\frac{dh_2(t)}{dt} = \frac{1}{S}\left(q_2(t) + q_{32}(t) - q_{20}(t)\right),$$
$$\frac{dh_3(t)}{dt} = \frac{1}{S}\left(q_{13}(t) - q_{32}(t)\right),$$



Inputs		Outputs	
1st tank input flow rate	$q_1(t)$	1st tank level	$h_1(t)$
		2nd tank level	$h_2(t)$
2nd tank input flow rate	$q_2(t)$	3rd tank level	$h_3(t)$

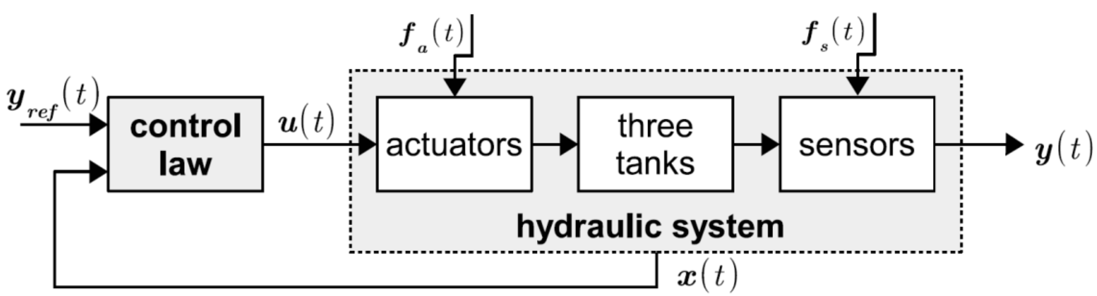
max flow rate q_{1max}, q_{2max}	1.5×10^{-4} m^3/s
max tanks levels h_{1max}, h_{2max}, h_{3max}	0.62 m

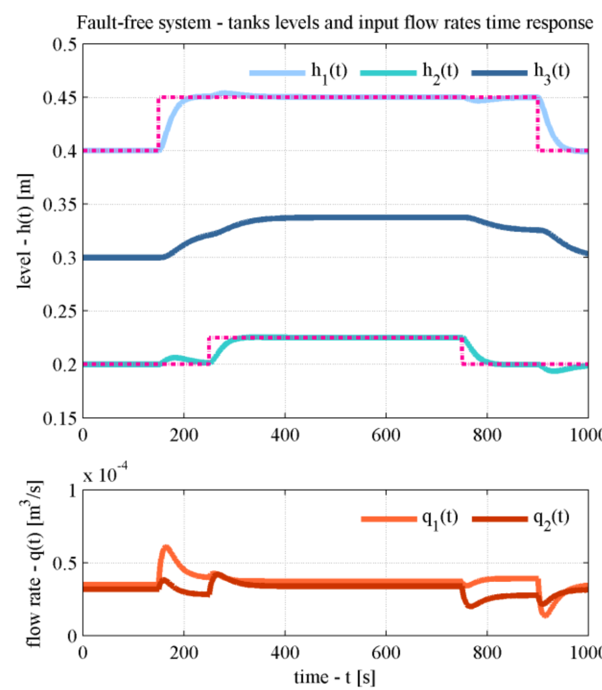
2. CONTROL DESIGN

- only the 1st and 2nd tank are controlled in order to maintain controllability of the hydraulic system

- state feedback control with integrator $z(k)$ using pole placement method

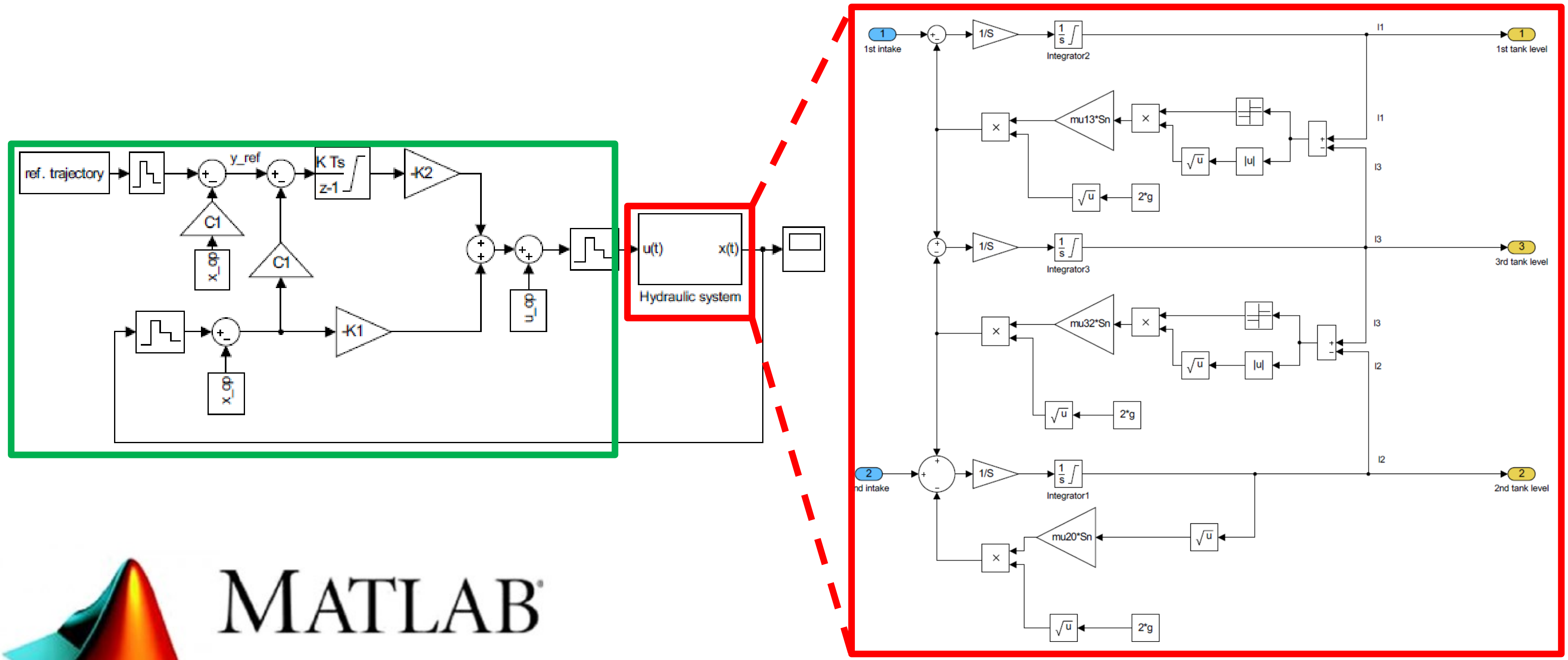
$$\mathbf{u}(k) = -\mathbf{K}_1\mathbf{x}(k) - \mathbf{K}_2\mathbf{z}(k)$$





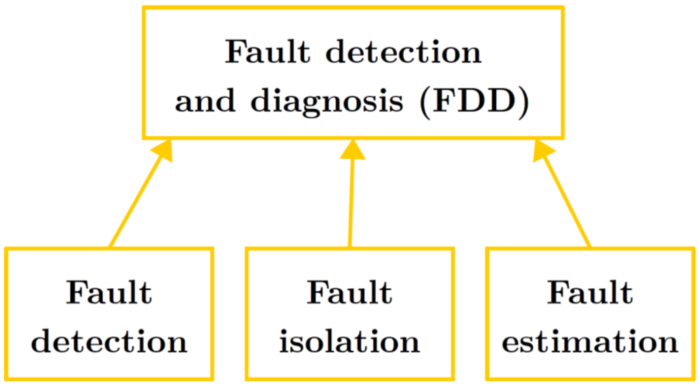
3. SIMULATION MODEL

- implementation of the hydraulic system in selected control structure into the MATLAB/Simulink environment

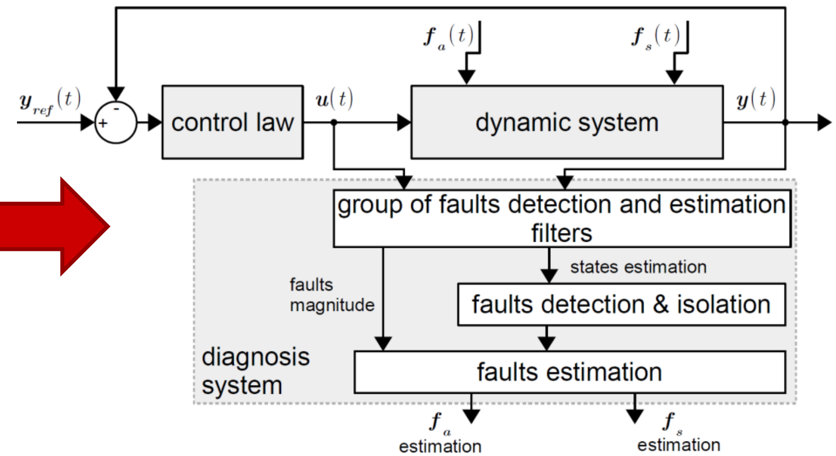


4. MODEL-BASED FAULT DIAGNOSIS METHODS OF DYNAMIC SYSTEMS

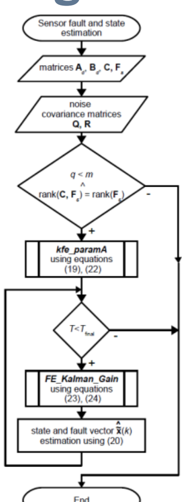
1. FDD methods



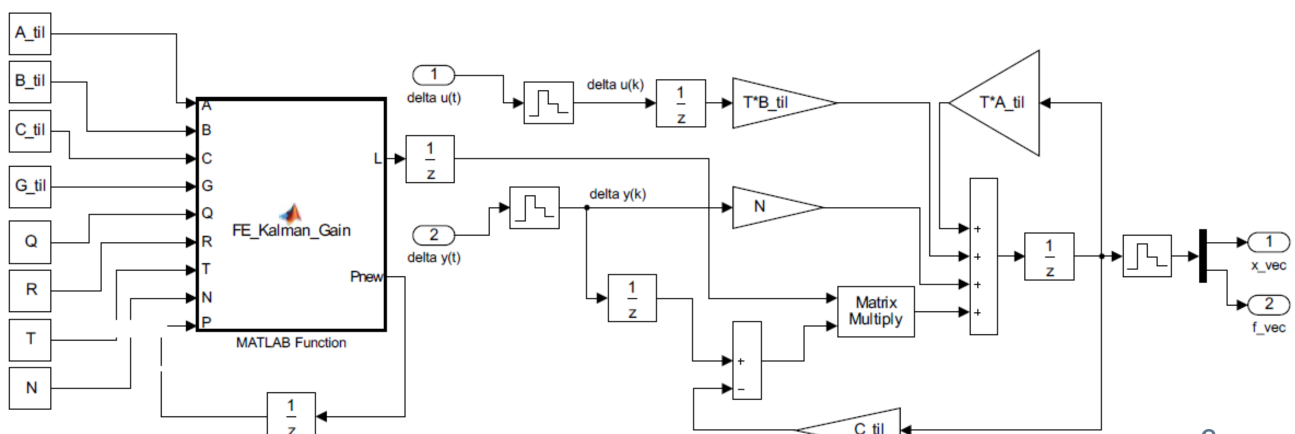
2. selected structure



3. FDD algorithms design



4. implementation into the MATLAB/Simulink



SUMMARY (1)

- state feedback control design and verification using the hydraulic system and its implementation in selected control structure in MATLAB/Simulink
- algorithm design for the fault estimation of the hydraulic system sensors and its implementation in MATLAB/Simulink
- prepared methodology for the fault diagnosis of the dynamic system
- results was summarized in the paper *SENSORS FAULT DIAGNOSIS ALGORITHM DESIGN OF A HYDRAULIC SYSTEM*, which was accepted in *Acta Electrotechnica et Informatica* journal

SUMMARY (2)

- predictive control design and verification using the Ball and Plate and its implementation in selected control structure in MATLAB/Simulink
- concept design of the diagnosis system
- results was summarized in the paper *INTELLIGENT POSITIONING PLATE PREDICTIVE CONTROL AND CONCEPT OF DIAGNOSIS SYSTEM DESIGN*, which was accepted in the *Journal of Manufacturing and Industrial Engineering*

NEXT STEPS

- design and verification of fault tolerant control structures
- implementation of algorithms within distributed control system
- member of **ALICE Collaboration** in CERN Alice experiment
- Detector Control System ALICE – solving tasks
- summarized of the PhD. research in dissertation thesis

Dissertation thesis is solved within the projects:

- Experiment ALICE on LHC in CERN: Study of strongly interacting matter at extreme energy densities
- University Science Park Technicom for innovative applications with knowledge technology support and 2nd phase
- KEGA 001TUKE-4/2015 – CyberLabTrainSystem and inovation
- Grant TUKE FEI-2015-33: Research Laboratory of Nonlinear Underactuated Systems

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THANK YOU FOR YOUR ATTENTION