

# Control of Systems Modeled by COMSOL Multiphysics as Distributed Parameter Systems

**Abstract**  
 In systems and control theory dynamical systems described by partial differential equations are known as distributed parameter systems. So for modeling and dynamical analysis of distributed parameter systems, wide possibilities are being offered by COMSOL Multiphysics, based on numerical solution of sets of partial differential equations by means of finite element method.

This paper presents actual possibilities of control of systems modeled by COMSOL Multiphysics as distributed parameter systems in MATLAB & Simulink software environment by Distributed Parameter Systems Blockset for MATLAB & Simulink – Third-Party Product of The MathWorks ([www.mathworks.com/products/connections](http://www.mathworks.com/products/connections)). As model control problems, controlled heating of a complex-shape metal body as well as temperature field control of glass-melting furnace are demonstrated here. Finally, a service is presented for interactive formulation and solution of model control problems via the Internet ([www.dpscontrol.sk](http://www.dpscontrol.sk)).

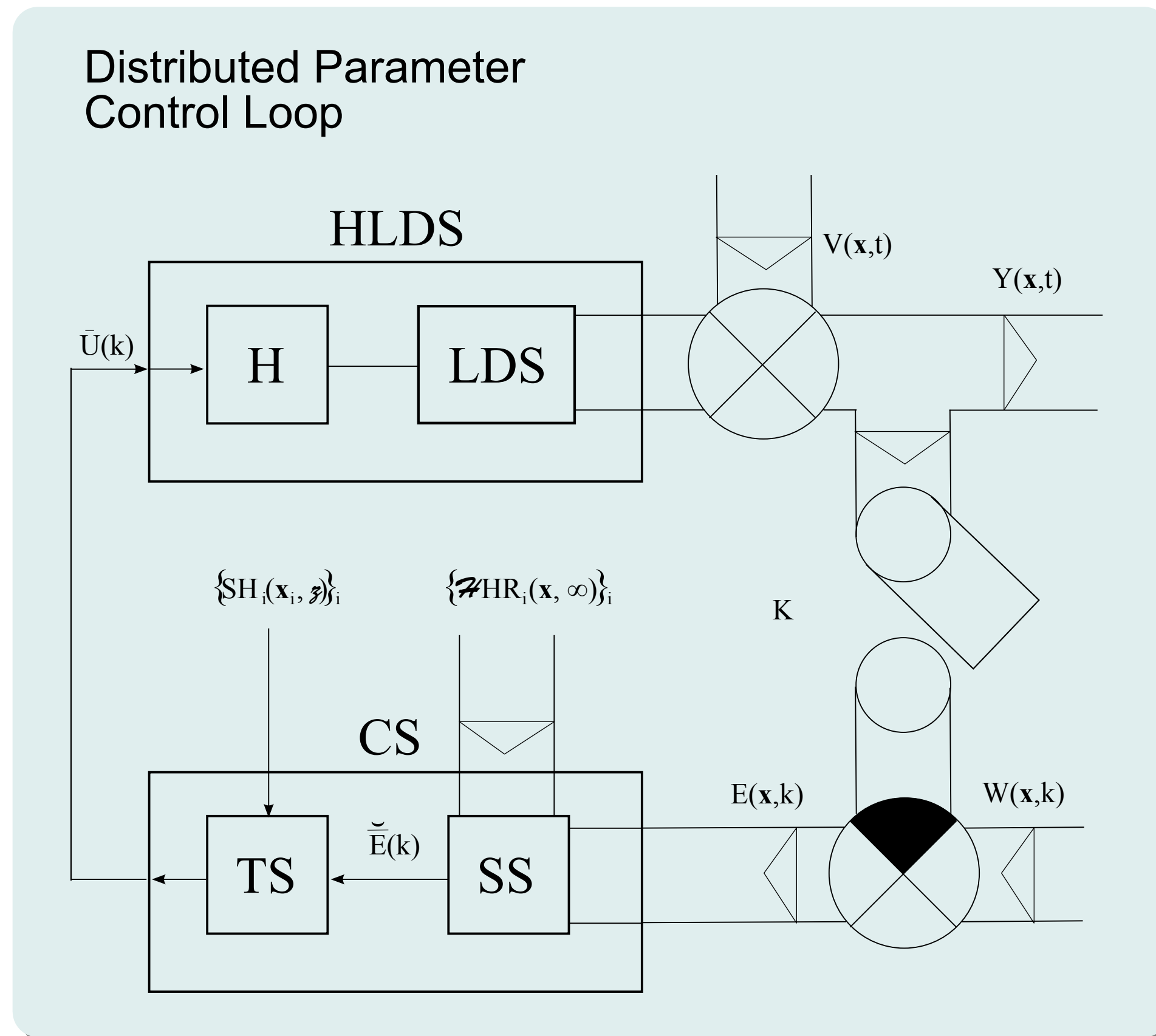
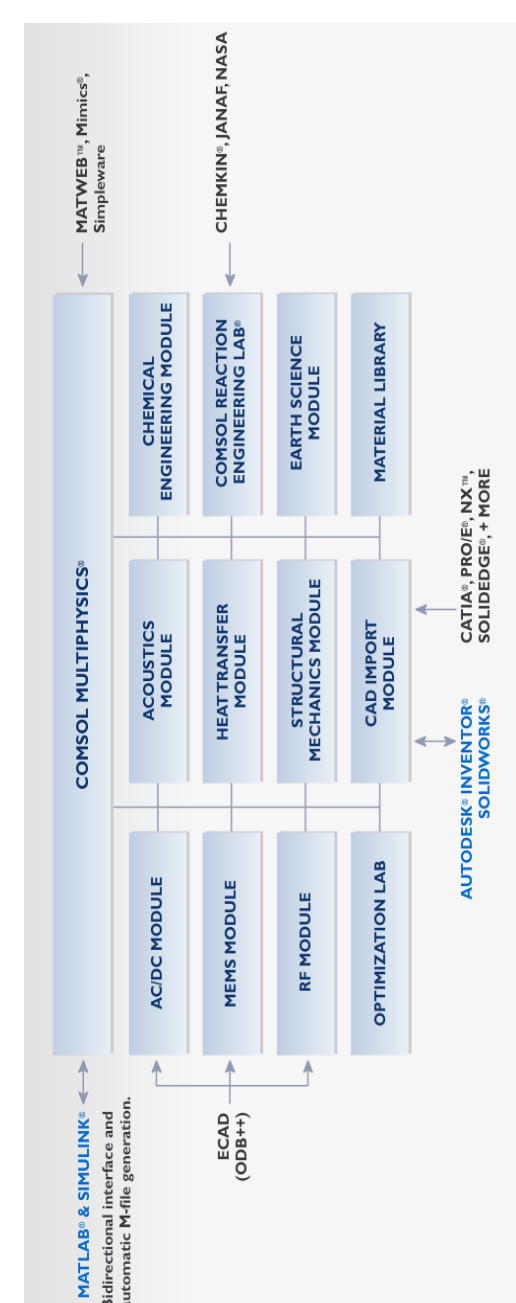
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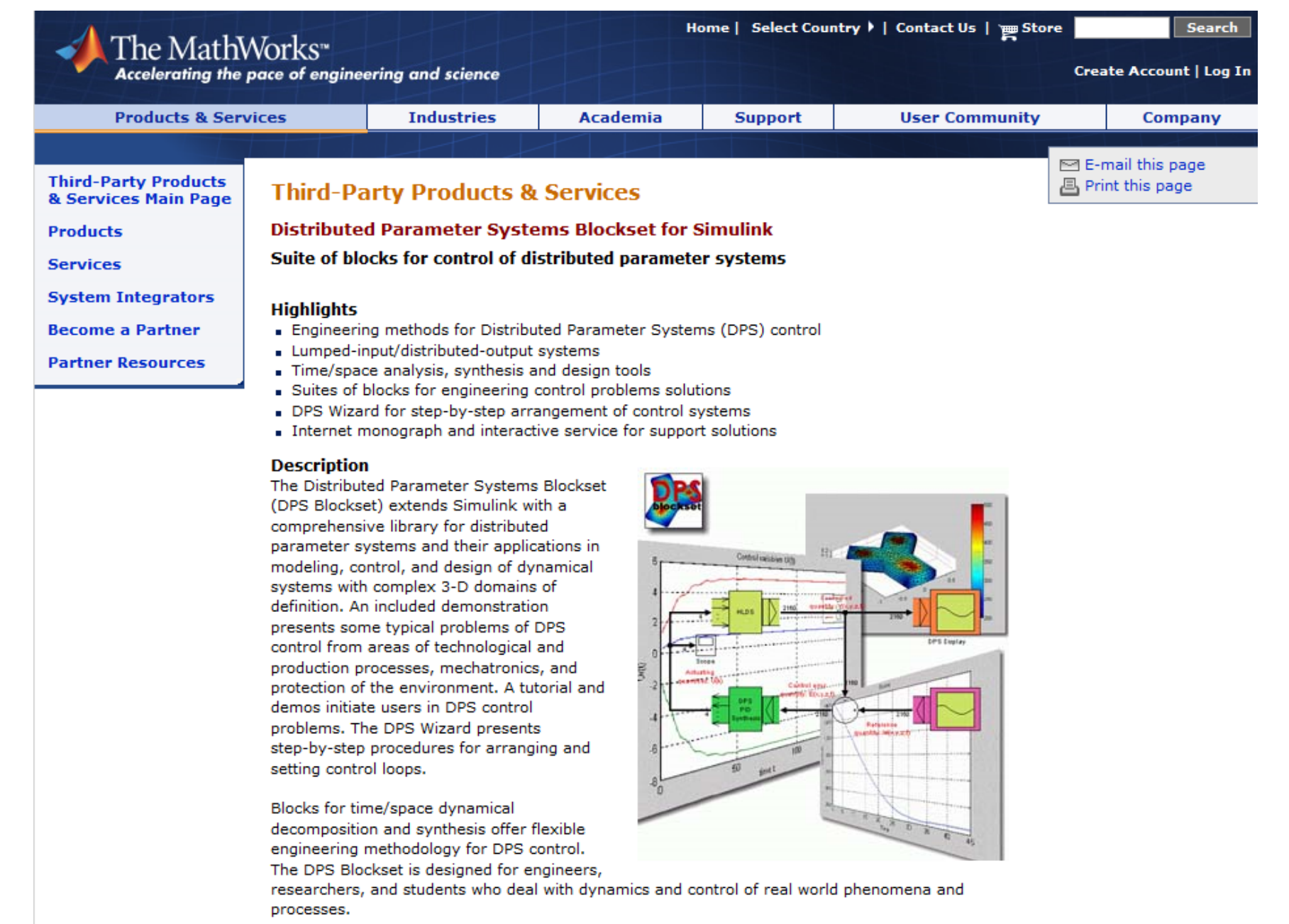
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## Distributed Parameter Control Loop

Controlled systems - HLDS - mathematical description by sets of partial differential equations as distributed parameter systems



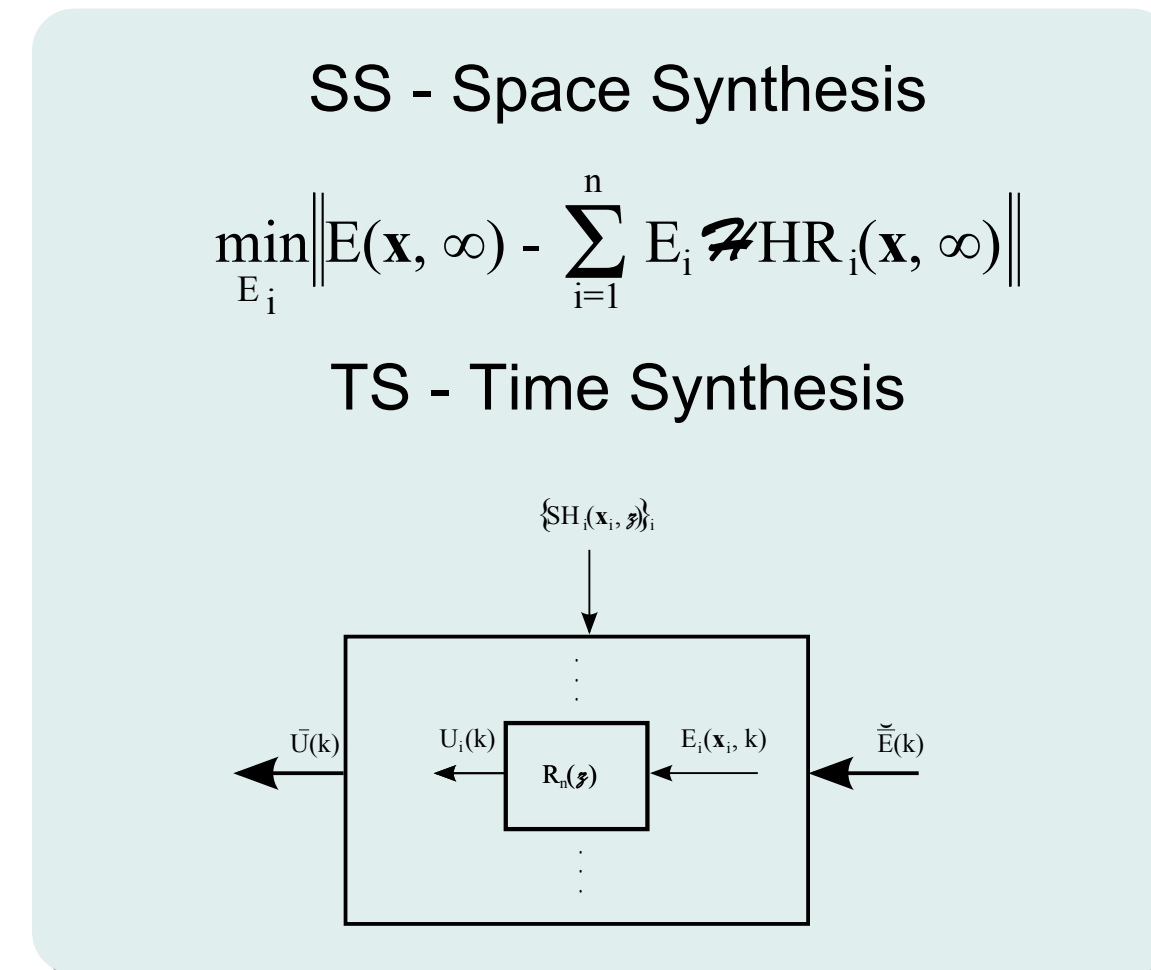
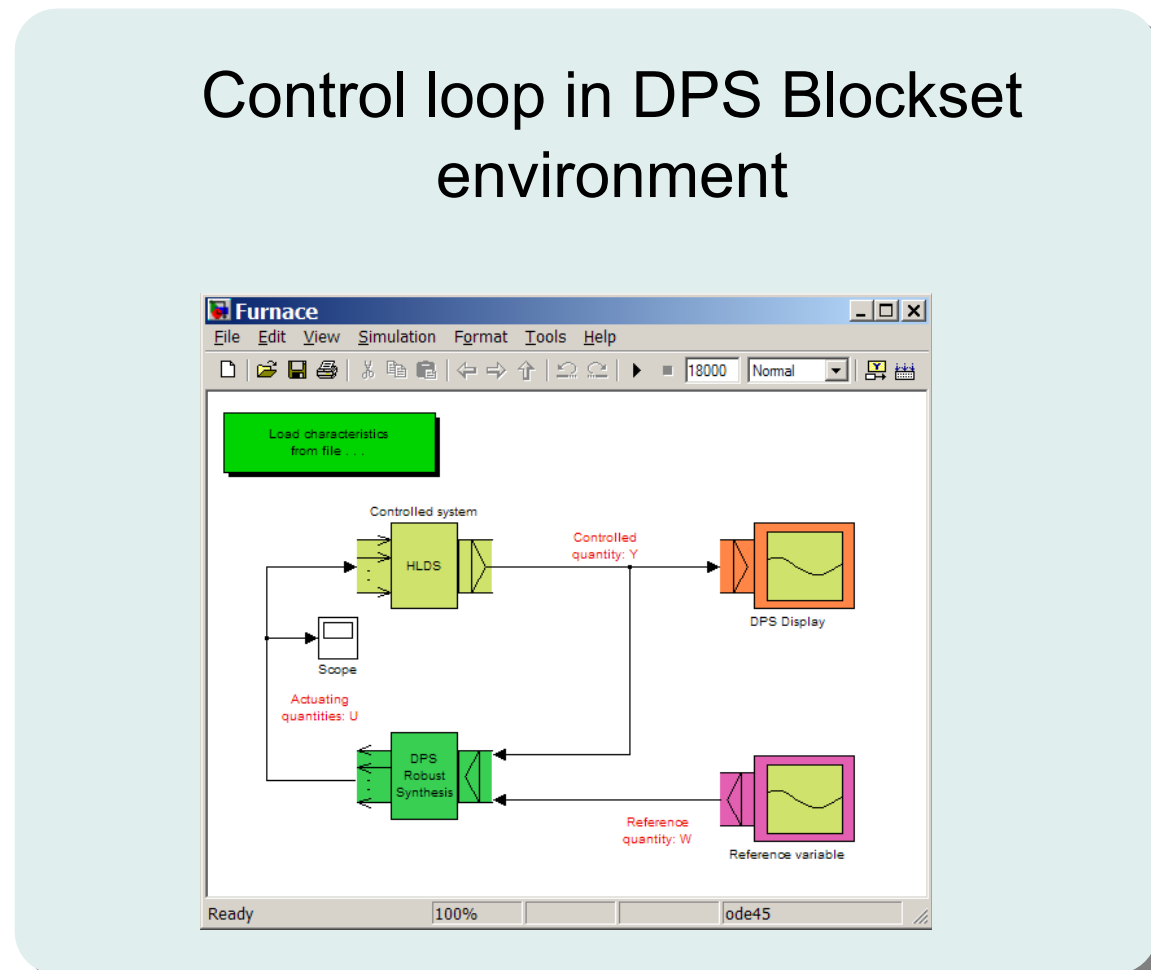
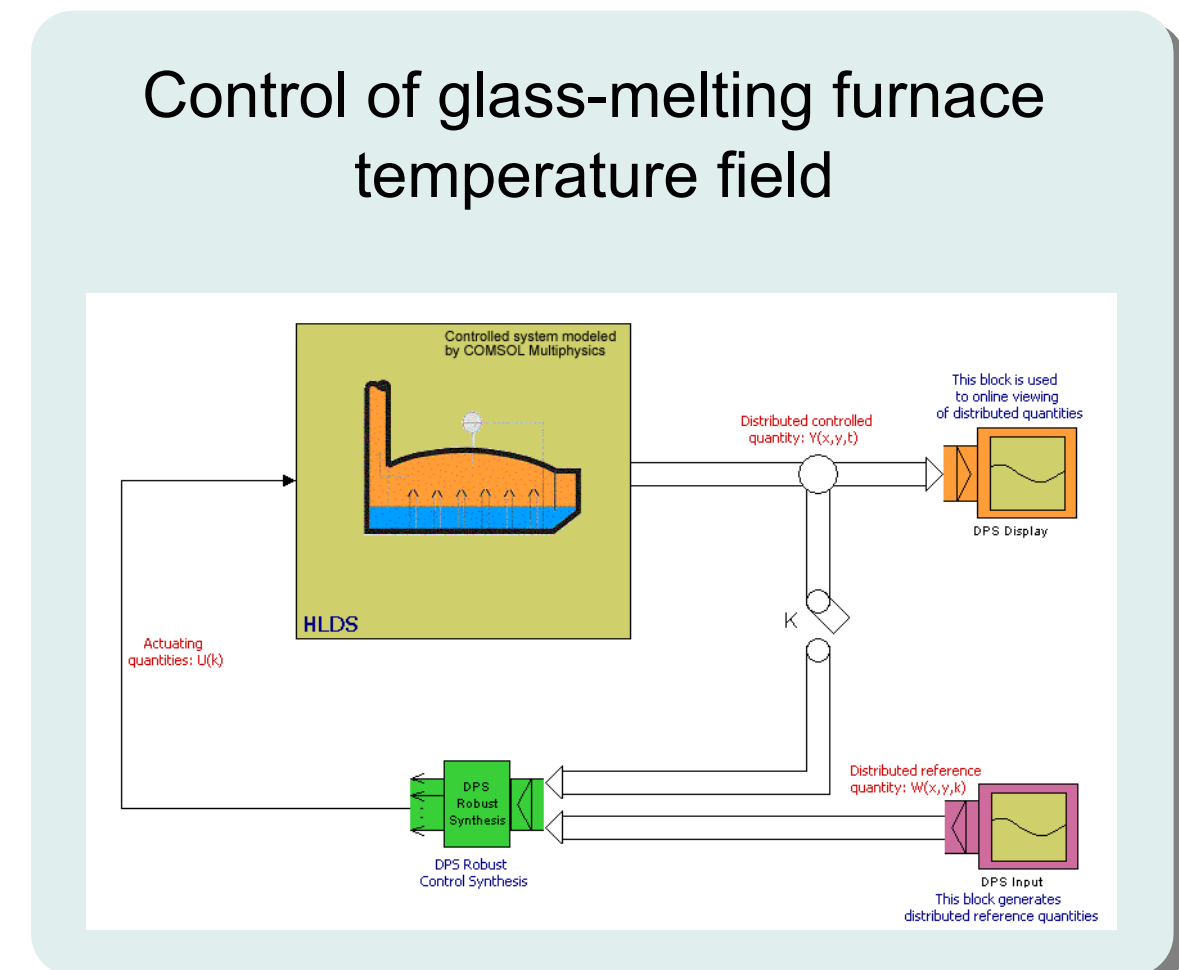
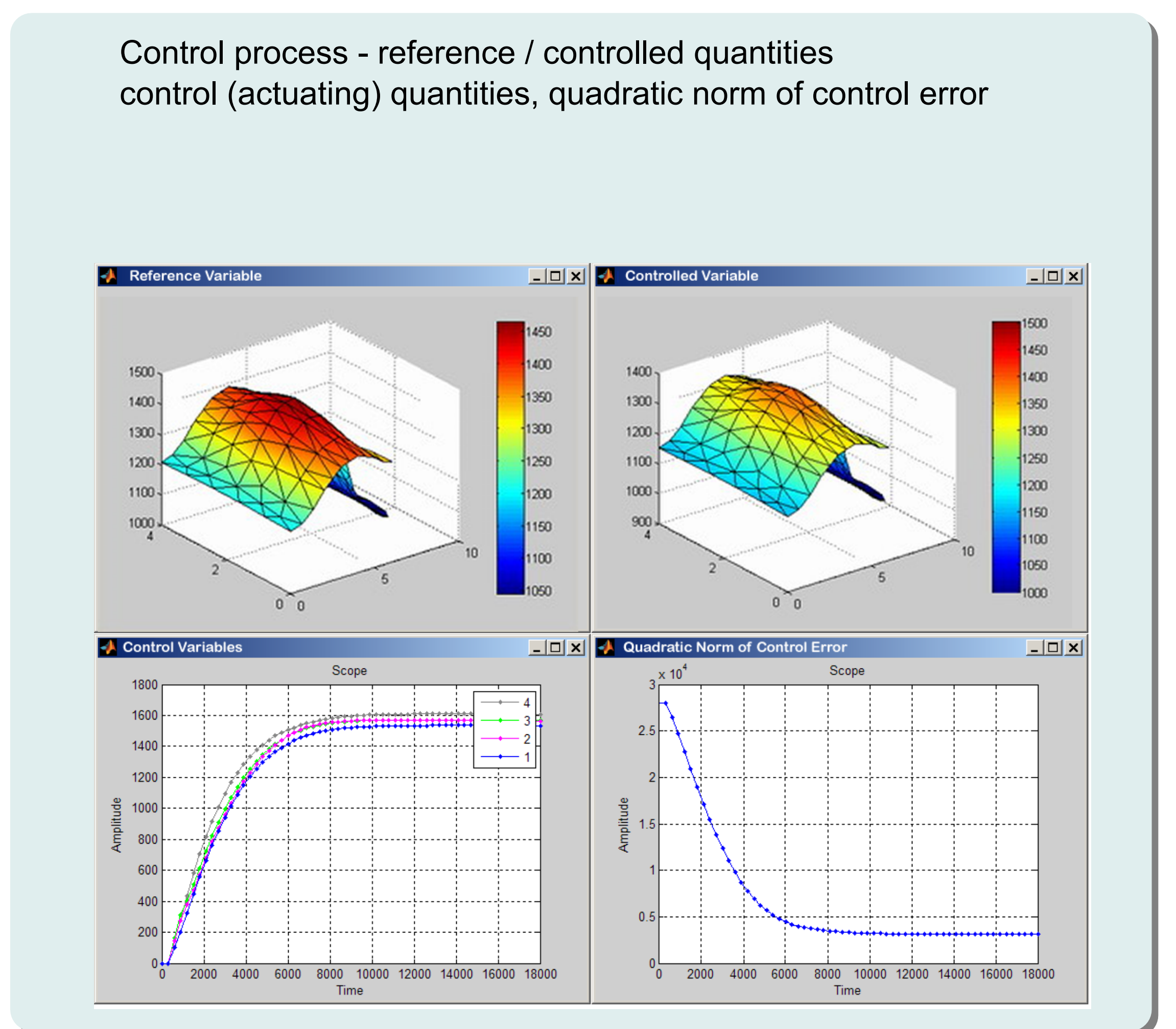
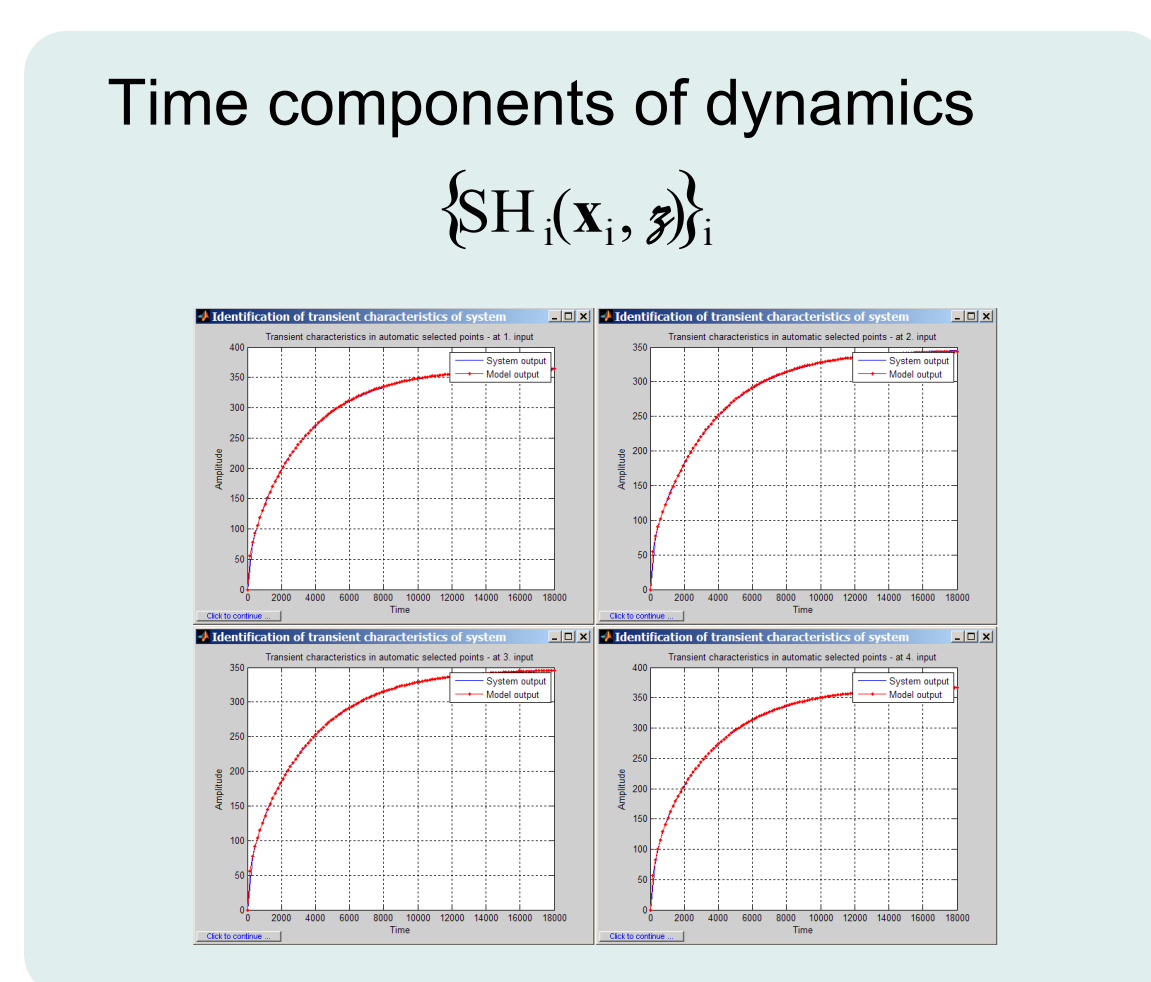
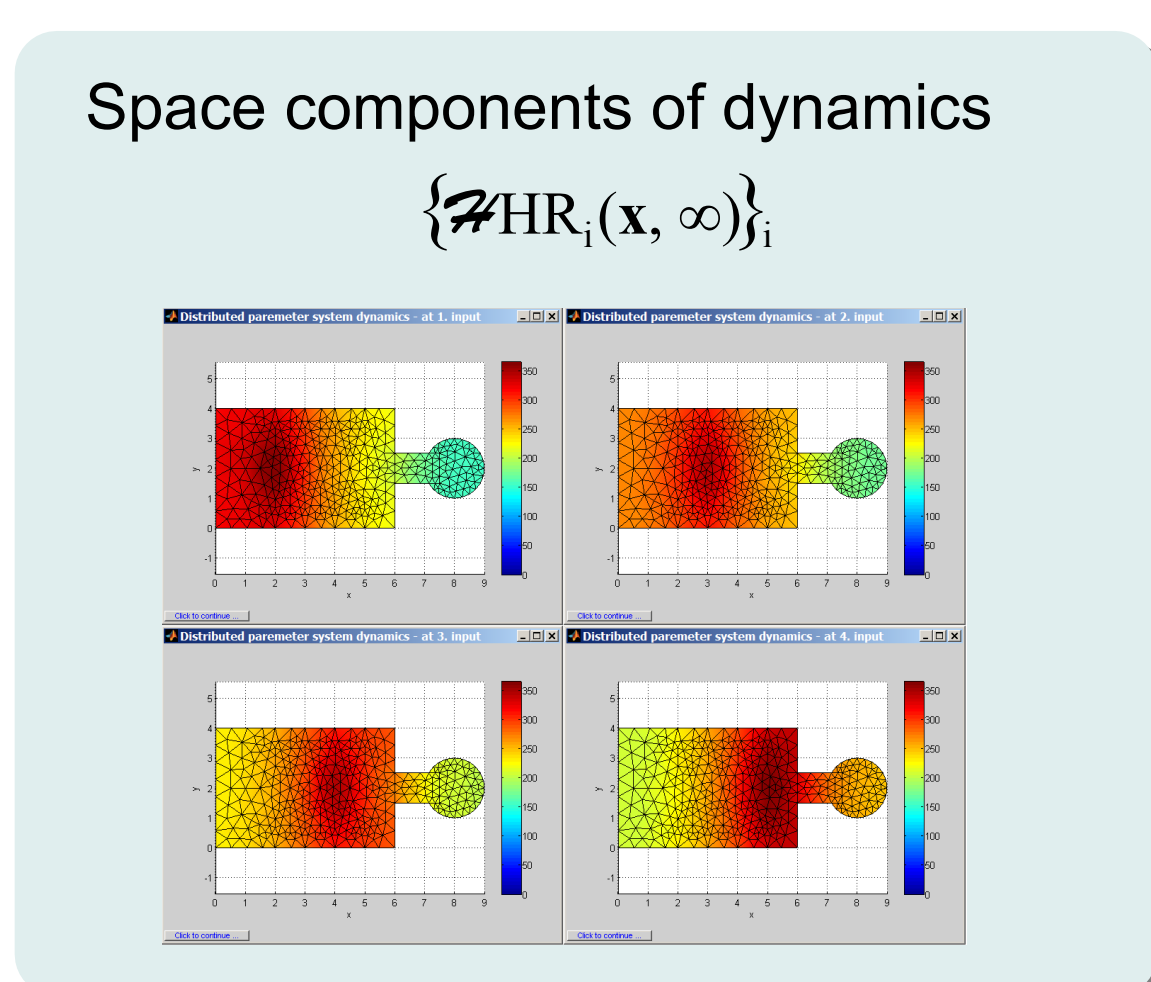
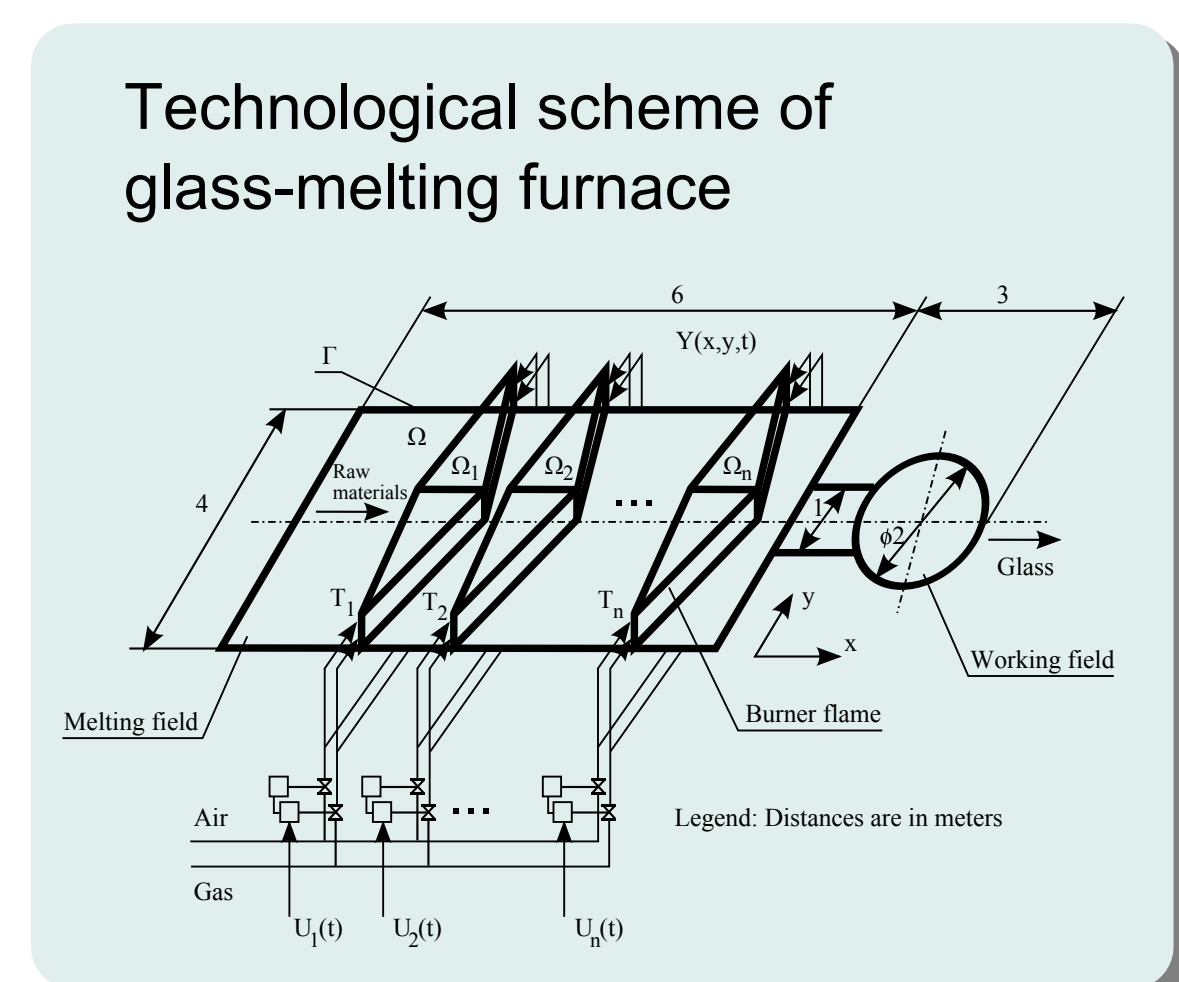
Identification and synthesis of control by methods of control theory



Modeling and dynamical analysis of controlled systems - HLDS - in COMSOL Multiphysics environment

Design of control loops in DPS Blockset for MATLAB & Simulink – Third-Party Product of The MathWorks

## Control of Temperature Field of Glass-melting Furnace



## Interactive Control via the Internet

Web portal: Distributed Parameter Systems [www.dpscontrol.sk](http://www.dpscontrol.sk) with Interactive Control and Download of DPS Blockset

The library of DPS Blockset

**Formulation**

- » geometry model -  $M$  (nodal coordinates)
- » amplitudes of lumped input step changes -  $\{U_i\}$
- » time sampling period -  $T$
- » transient response matrices -  $\{H_i\}$
- » reference quantities in mesh nodes -  $W(x, y, z, \infty)$

**Solution**

- » actuating quantities
- » quadratic norm of control error
- » controlled quantity
- » control error

Results of the control process will be transferred to You via FTP in the form of DPS Blockset outputs.

Please, submit this FORMULATION via the Internet to [ftp.dpscontrol.sk](ftp://ftp.dpscontrol.sk). Before arrangement of the FORMULATION and for the FTP server username and password please contact us on address [gabriel.hulko@stuba.sk](mailto:gabriel.hulko@stuba.sk)