Otto-Von-Guericke-University-Magdeburg
Department of Mathematics-Institute for Analysis and Numerik
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Computational Methods for Systems and Control Theory

Summer Term 2014
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Model Reduction of Dynamical Systems - 5

Deadline for homework: 10/07/2014

Task: 1 (Quadratic Model Order Reduction)

Consider the nonlinear RC circuit example discussed in the lecture notes and represent the system in quadratic form. Use MATLAB ODE15s solver to solve the original nonlinear system and the quadratic form of the system.

Implement the quadratic MOR method for the RC circuit example with order $r = 20$ using zero as expansion point for the quadratic form. Plot the output of the original nonlinear system, the quadratic form of the nonlinear system and the reduced quadratic form of nonlinear system with respect to time. Choose the time interval between 0 and 10 with 150 equally spaced points.

Task: 2 (Propor Orthogonal Decomposition (POD) method)

Implement the POD method discussed in the course. Using 20 snapshots of the state vector associated with the original system, compute reduced order nonlinear model of dimension 5 and compare your results with the actual nonlinear model by using the model of the nonlinear RC circuit.

Task: 3 (POD with DEIM)

Implement the POD as in Task 2 but with the Discrete Emperical Interpolation method (DEIM) in order to reduce the computational complexity of the nonlinear function in the RC circuit example. Plot the output of the actual and the reduced system and compare the results.

Send your routines to *imahmad@mpi-magdeburg.mpg.de*. The filename should include your name and the corresponding exercise sheet number as well as the exercise number, e.g., name-hw1e5. In case of several files please hand in a compressed file. Moreover, please print the source code of your routine and hand it in together with the other exercises.