8th. World Congress on Computational Mechanics (WCCM8)
5th European Congress on Computational Methods in Applied Sciences and Engineeering (ECCOMAS 2008)
June 30 –July 5, 2008
Venice, Italy

A POLYNOMIAL MULTIPARAMETER EIGENVALUE PROBLEM ARISING FROM DELAY DIFFERENTIAL EQUATIONS

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Key Words: *Delay differential equation, polynomial multiparameter eigenvalue problem, multiparameter eigenvalue problem, quadratic eigenvalue problem.*

ABSTRACT

We study the critical delays for time-delay systems (differential equations with a delay): the delays for which the system has a purely imaginary eigenvalue. We show that this may lead to a new type of eigenvalue problem: the polynomial multiparameter eigenvalue problem. In our case, we get a certain quadratic two-parameter eigenvalue problem, which combines properties of the quadratic eigenvalue problem and the two-parameter eigenvalue problem.

We present a subspace approach to numerically approximate critical delays for large matrices. One of the ingredients of the method is an inexact accelerated Newton technique.