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Stephen B. Wineberg* (wineberg@comcast.net), Department of Mathematics, Kingsbury Hall, 33 College Road, Durham, NH 03824-2619. "*Numerical Analysis of Spectral Properties of Operators Generated by an Aircraft Wing Model*". Preliminary report.

ABSTRACT

This talk concerns numerical approximation of the eigenvalues of a non-selfadjoint fourth-order matrix differential operator arising from a much-studied model of aircraft wings subject to subsonic air flow.

We discretize the fourth-order matrix differential operator, defined on a domain with nine boundary conditions, using Chebyshev polynomials. Depending on how the boundary conditions are imposed and how the fourth derivatives are handled, this leads to several different, but mathematically equivalent, matrix systems.

Despite their mathematical equivalence, calculating the eigenvalues of these systems gives dramatically different results, even using 17 digits of accuracy for the numerical computations. This discrepancy is explained by the fact that all but one of the systems is extremely ill-conditioned.

The one sufficiently well-conditioned system is generated by a method of imposing the boundary conditions as the kernel of a well-conditioned matrix. This yields a matrix whose distribution of eigenvalues agrees very closely with the qualitative distribution of eigenvalues for the continuous problem, which has been derived by A. V. Balakrishnan and Marianna A. Shubov, using theoretical considerations. (Received February 17, 2006)