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**ETNA**
**Kent State University**
**etna@mcs.kent.edu**

# AN ANALYSIS OF THE POLE PLACEMENT PROBLEM II. THE MULTI-INPUT CASE*

VOLKER MEHRMANN† AND HONGGUO XU‡

**Abstract.** For the solution of the multi-input pole placement problem we derive explicit formulas for the subspace from which the feedback gain matrix can be chosen and for the feedback gain as well as the eigenvector matrix of the closed-loop system. We discuss which Jordan structures can be assigned and also when diagonalizability can be achieved. Based on these formulas we study the conditioning of the pole-placement problem in terms of perturbations in the data and show how the conditioning depends on the condition number of the closed loop eigenvector matrix, the norm of the feedback matrix and the distance to uncontrollability.

**Key words.** pole placement, condition number, perturbation theory, Jordan form, explicit formulas, Cauchy matrix, Vandermonde matrix, stabilization, feedback gain, distance to uncontrollability.

**AMS subject classifications.** 65F15, 65F35, 65G05, 93B05, 93B55.

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† Fakultät für Mathematik, TU Chemnitz, D-09107 Chemnitz, FR Germany. This work was supported by Deutsche Forschungsgemeinschaft, Research Grant Me 790/7-2.

‡ Fakultät für Mathematik, TU Chemnitz, D-09107 Chemnitz, FR Germany. This work was supported by Alexander von Humboldt Foundation, Chinese National Natural Science Foundation and Deutsche Forschungsgemeinschaft, Research Grant Me 790/7-2 .