

## Design of a fuzzy controller for feed drive systems of CNC machines

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The feed drive and its computer control system is an important component of CNC machines whose performance plays a key role in precision of the machining system. The feeddrive system typically consists of a servomotor, coupling, lead screw and nut, support system (i.e., bearings and linear slides), electrical drive (for position measurement); and a computer based controller for position control. While each of these components affects performance, contribution of the servo controller has a major impact on the accuracy of the entire system. This paper introduces a new approach based on fuzzy set theory to design of the servo controller for accurate positioning of the axis motion. The advantage of this approach is that no prior knowledge of the system model involved, in this case the dynamics of the drive system, is required. In essence, this technique mimics the decision making process of human being in dealing with a physical dynamic system. In this study, a fuzzy controller is designed for real time control of CNC feed drive systems. In this regard, the structure of a fuzzy controller is determined and the fuzzy rules are defined that are further used to design and develop the controller. To study the controller performance, a linear model of the systems is developed in the state-space format which takes into account the electrical characteristics of the servo system, stiffness, inertia, and damping properties of individual components of the feed drive system. This model is further used in analysis of the system performance through simulation studies and the results are presented.

### Biography

M. G. Mehrabi is an Associate Professor of Mechanical Engineering teaches courses in the areas of manufacturing systems, manufacturing processes, computer integrated manufacturing, and quality control systems. He received his Ph.D. in Mechanical Engineering from Concordia University (Montreal, Canada) in 1994. Prior to joining UDM in 2002, he was a research faculty in the Department of Mechanical Engineering at the University of Michigan, Ann Arbor. He has several years experience (academia and industry) in research, design and development of modern manufacturing systems, advanced processes and their monitoring systems, industrial control systems and industrial automation. His research interests and publications are in general area of advanced manufacturing systems, computer control of manufacturing systems, computer integrated manufacturing, and automation of production systems (hardware and software). He is a reviewer of several reputable journals/conferences in his areas of interest. Mehrabi is the recipient of the award of Natural Sciences and Engineering Research Council of Canada (NSERC) for outstanding research achievements in 1996 and the winner (year 1995) of the Quebec Government Industrial Fellowship, Canada.

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