

Preface

Manufacturing is the oldest process responsible for producing various types of products involving all spheres of human civilization. With the growing demand for variety in products, customization and quality, the need arises to explore innovative ways to meet these challenges. Process planning/setup planning plays a key role in manufacturing process and it essentially paves the way from design phase to manufacturing phase. It bridges the functional gap between design and manufacturing. Process planning and setup planning methods are vital for the functionality, efficiency, cost, and quality of a finished product. It has been an active research area in the last three decades and widely investigated by various researchers.

The scope of this book is limited to setup planning in machining context. Setup planning is an intermediate phase of process planning and it is essentially the core of a process planning system. Setup planning includes determination of the setups needed to machine a component, setup and machining operation sequencing, selecting datum, and selecting jigs and fixtures. The knowledge of different types of features, their dimensions, tolerances, machine tools and their capabilities, cutting tools, machining operations, and fixtures are essential for setup planning. Challenging issues like automation, integration, compatibility and proper interfacing, flexibility in setup planning, etc., are addressed in this book. The use of soft computing techniques in solving setup planning problems is also discussed.

The first chapter of the book essentially introduces process planning and setup planning in machining context along with the different approaches of setup planning. In Chap. 2, different phases of setup planning task, viz, feature grouping, setup formation, datum selection, machining operation sequencing, and setup sequencing are discussed with relevant examples. Setup planning has been an active area of research for a long time. Chapter 3 reviews major efforts of setup planning by various researchers using diverse methods. Application of the traditional approaches like decision tree, decision table, group technology, algorithms and graphs, artificial intelligence tool like expert system, soft computing techniques like fuzzy sets, neural networks, and evolutionary optimization methods to setup planning are presented in this chapter. Chapter 4 describes the application

of fuzzy set theory to take care of the uncertainty and imprecision associated with setup planning knowledge. Chapter 5 addresses an important issue of assigning proper membership grades to fuzzy variables. A method for fine-tuning the membership grades combining the expert's opinion and available practical data is described with an example. Chapter 6 reviews different types of fixtures and the relevant research in the area. Emphasis is given on the need for fixturing consideration during setup planning stage for a practical and feasible setup planning solution.

This book may be used as a part of a course on manufacturing engineering at both the undergraduate and postgraduate level. It can also be used as a reference by the researchers in the broad area of process planning and setup planning. We welcome the feedback of readers.

We thank Prof. J. Paulo Davim for motivating to write us a monograph on setup planning. We also want to acknowledge Dr. Sankha Deb for the fruitful discussions we had with him on setup planning. The cooperation of the staff members of Springer is also acknowledged.

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