National Repository for Design and Process Planning

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Abstract

The National Institute of Standards and Technology's (NIST) Design, Planning and Assembly Repository is a publically accessible collection of 2D and 3D CAD and solid models taken from a wide variety of sources in industry and academia. The goal of this project is to provide research and development efforts with a means to obtain and share examples, focus on benchmarks, and identify areas of research need. The Repository is available through the World Wide Web at URL `http://www.parts.nist.gov/parts`.

The Design, Planning and Assembly Repository is an effort at the National Institute of Standards and Technology (NIST) joining government agencies, industry, and academia to provide a library of example data for use by the research community. The ascendency of the Internet and the World Wide Web has provided the communication medium to build vital online libraries having wide user-bases and access and it is the goal of the Repository to give researchers access to a wide variety of problems taken from industry—thus improving the base of common working knowledge for the community and giving students access to challenging and high-impact problems. The Repository will also provide a focal point for collaboration, allowing researchers to post challenge problems to a wide audience, share results, or perform larger-scale experiments requiring bigger data sets with industrially relevant data. It is our belief that establishment of this Internet-enabled communal library will hasten advances in manufacturing process planning, feature recognition, and assembly planning.

The NIST Design, Planning and Assembly Repository (`http://www.parts.nist.gov/parts`) has initially been designed to serve three research communities: **Manufacturing Process Planning**, **Feature Recognition and Feature-based Manufacturing** and **Assembly Planning**. Although significant progress has been made in these areas, at present there are no fully automated process planning systems capable of automatically performing the complete planning task. Further complicating matters is that most previous research efforts have proceeded in isolation, each focusing on some particular sub-domain with its own idiosyncratic examples. Current needs require a more efficient mechanism for collecting and disseminating examples.

Repository Contents The Repository covers many commonly used manufacturing processes. Because machining has been among the most widely researched manufacturing process, the current contents of the Repository are biased in this way—including many examples from previous research work in machining and assembly planning (see Figure 1). Many of these models are taken directly from industry and describe artifacts whose manufacturing plan might include several different steps and processes. At the time of this writing, the current content of the Repository includes nearly 2500 part models in a variety of formats.

All of the models in the repository are stored in at least one of the formats which are established international standards, industry standards, or industry-developed 'open' formats (STEP Application Protocol 203 (ISO 10303-203); IGES, ACIS .sat solid modeler file format, Bentley's MicroStation .dgn, Autodesk AutoCAD .dxf/.dwg; .prt, .neu, .asm from Pro/Engineer; Parasolid Transmit Files .xmt/.xmt_txt, .pfi from PADL-2, and several other formats). The Repository also contains a number of image and display formats for model files, including Postscript, CompuServe Graphical Image Format (GIF) and Virtual Reality Modeling Language (WRL).

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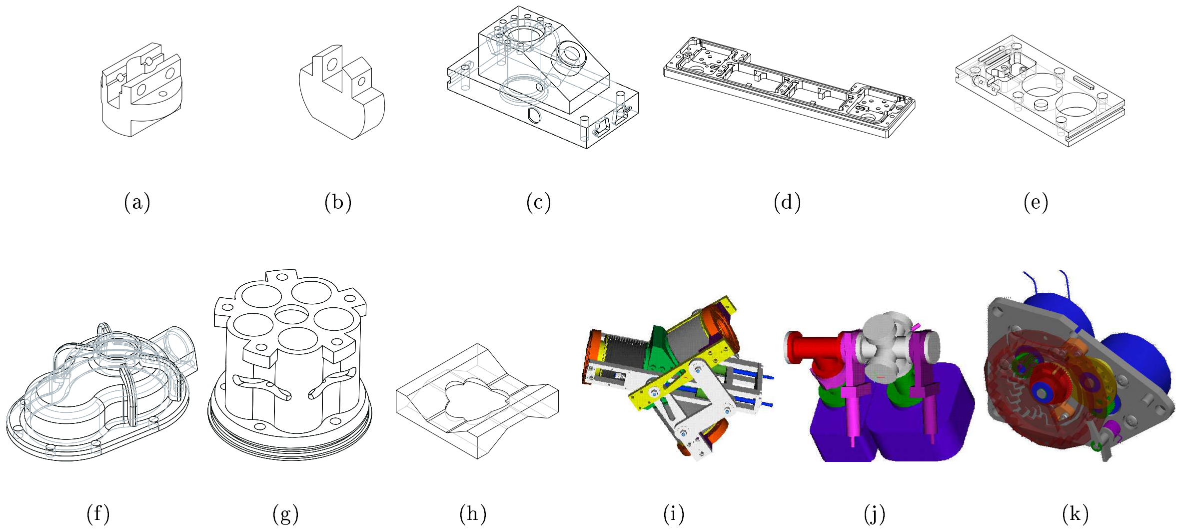

Figure 1: Example parts available at the NIST repository, `http://www.parts.nist.gov/parts`.

Summary The development of a common collection of realistic CAD/CAM data and parts is of critical importance for the R&D community. The lack of such a collection has been a significant impediment to building consensus on technical issues and research directions—often resulting in redundant research effort and excessive overlap. To address this, a Design, Planning, and Assembly Repository has been created at the National Institute of Standards and Technology. The deployment of this publically accessible library enables many exciting new research problems to be addressed.

Even in its current form, we anticipate that the Repository might serve as a prototype collaboratory [1] environment for researchers in these diverse areas and create a number of synergies. Active use of the Repository will greatly enhance its content, its value as a global resource, as well as benefit the research of those who use it. It is hoped that the establishment of this Repository, and its growth through the contributions of industry and academia, will lead to quicker advances on problems in engineering design and manufacturing automation.

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[1] Computer Science and Telecommunications Board. National collaboratories: Applying information technology for scientific research. Technical report, National Research Council, 2101 Constitution Avenue N.W., Washington, DC 20418, 1993. National Academy Press.

[1] Disclaimer: Certain software companies and commercial software systems are identified in this document. Such identification does not imply recommendation or endorsement by NIST; nor does it imply that the products identified are necessarily the best available for the purpose.