

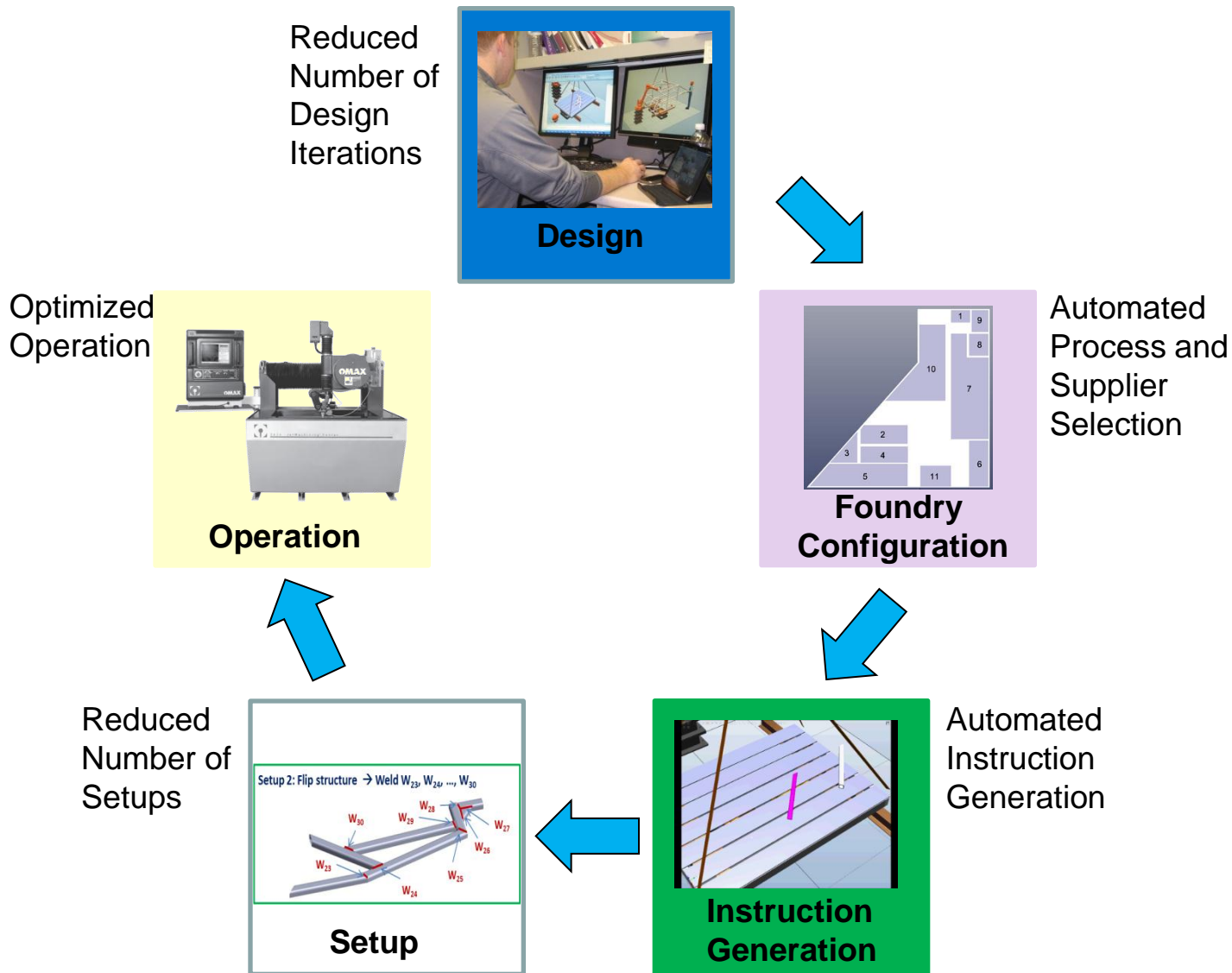
Automated Planning for iFab

Satyandra K. Gupta, Krishna Kaipa, Carlos Morato,
Ian Wang, Boxuan Zhao, and Petr Svec

University of Maryland, College Park

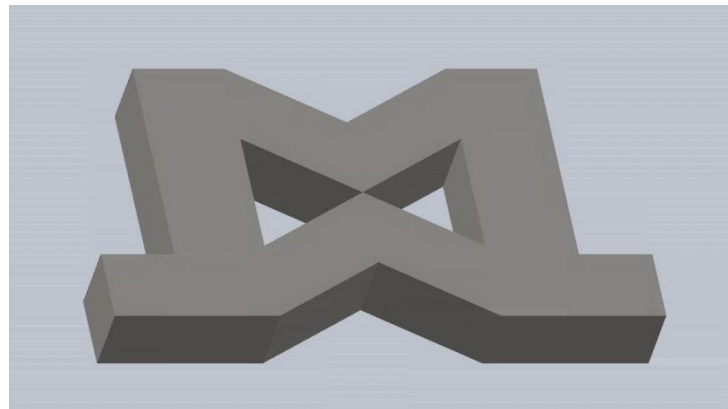
Sponsor: DARPA iFab Program

Role of Automated Planning in Schedule Compression

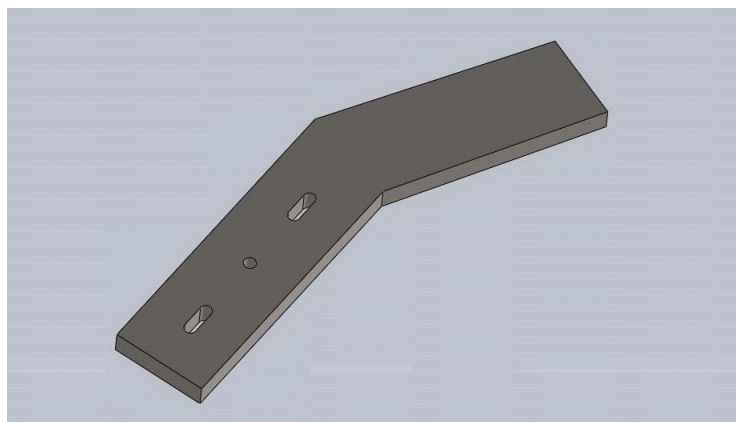


Automated Manufacturability Analysis for Cutting Operations

- Automatically perform manufacturability analysis with respect to a given set of resources
 - Machines
 - Tools
 - Available stock materials
- Provide descriptions of manufacturability problems (if needed) and cutting time estimates



Part cannot be produced in any water-jet machine

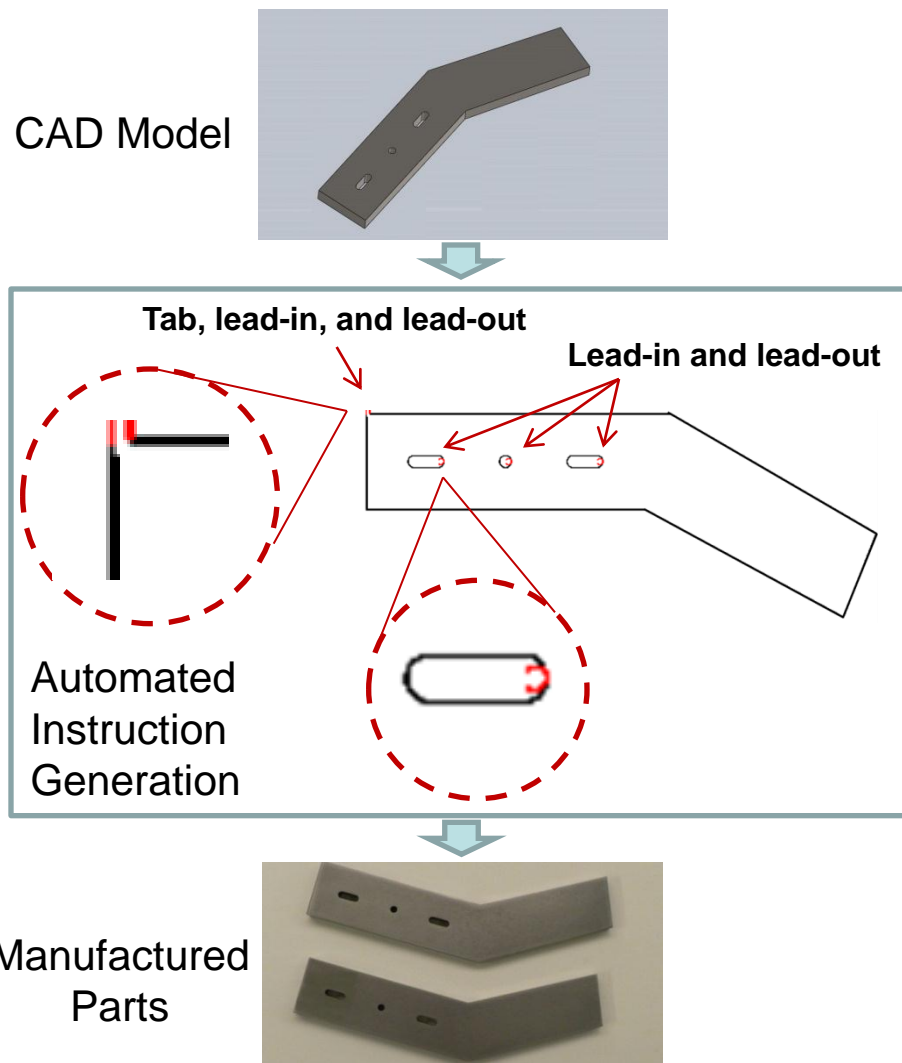


Part can be manufactured using
OMAX 2626 machine

Enables schedule compression by eliminating time-consuming design iterations!

Automated Instruction Generation for Water-jet Cutting

- Automatically select lead-in, lead-out, and tabs
- Automatically generate cutting instructions
- Does not require human process planner on most routine tasks

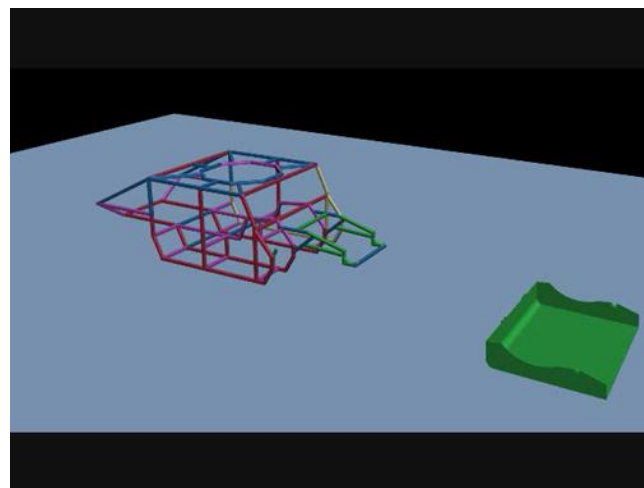


Enables going from CAD to part in few minutes!

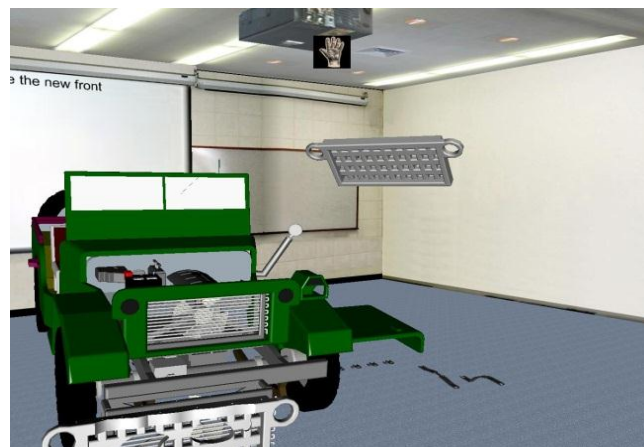
Automated Motion Planning

- Determines path for an object from initial position to final position in presence of obstacles
- Enables automated selection of assembly tools
- Enables automated generation of instructions for human operators

Motion planning for placing a hood on to the engine compartment















Motion planning for different initial and final postures



Enables schedule compression by reducing instruction generation time!

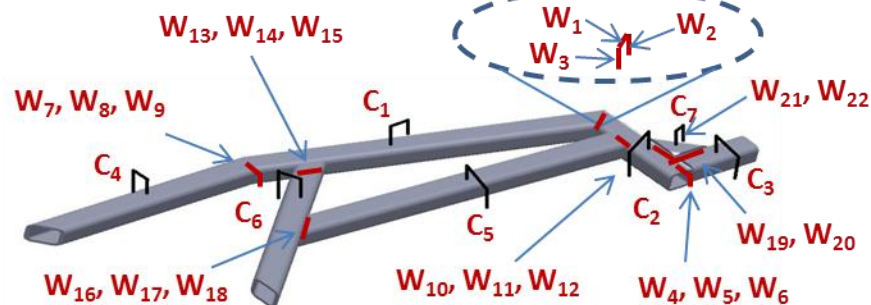
Setup Planning for Welding

- Compute optimal number of welding setups by performing trade-off between weld quality and setup time
- Account for welding cell constraints

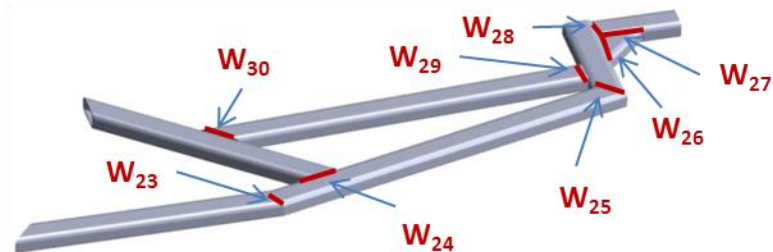
1		+	
2		+	
3		+	
4		+	
5		+	
6		+	



Setup 1: Clamp $C_1, C_2, \dots, C_7 \rightarrow$ Weld W_1, W_2, \dots, W_{22}



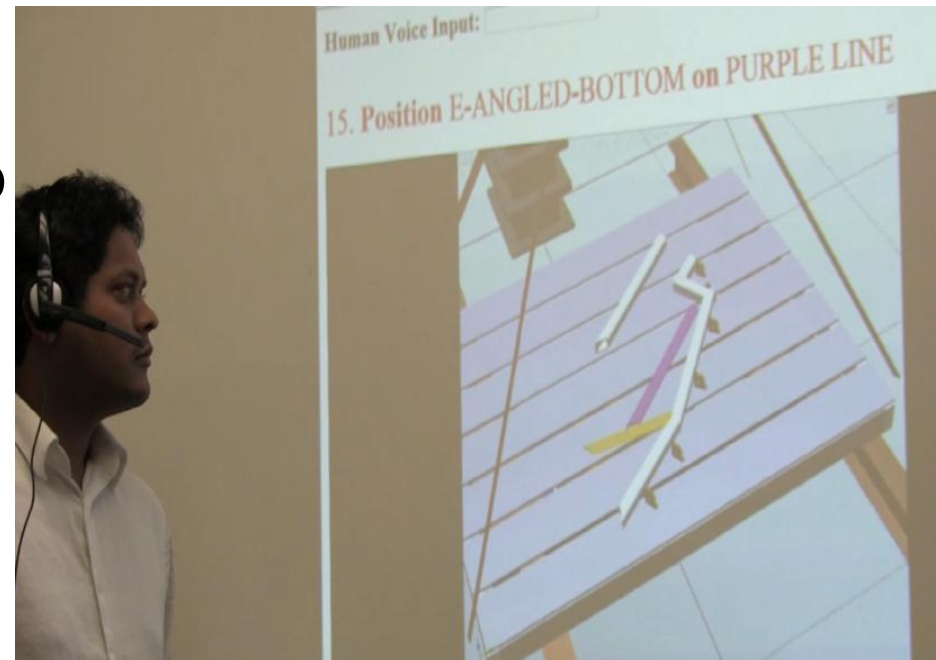
Setup 2: Flip structure \rightarrow Weld $W_{23}, W_{24}, \dots, W_{30}$



Enables schedule compression by reducing setup time!

Instruction Generation for Assembly Operations Performed by Humans

- Support augmented reality based setup
- Decompose assembly task into subtasks
- Select methods, tools, and parameters
- Generate text, images, and videos
- Voice-based interface for displaying instructions on the shop floor



Enables schedule compression by reducing instruction generation time and eliminating the possibility of assembly errors!

For more information please contact:
Satyandra K. Gupta (skgupta@umd.edu)