Hard Turning and ATP

Shreyes N. Melkote, Ph.D.
Assistant Professor of Mechanical Engineering

PMRC Industrial Advisory Board Meeting
October 18, 2000
Hard Turning Research Goals

- To develop a fundamental understanding of material removal and surface generation mechanisms, and tool wear in hard turning.

- To develop predictive models and advanced process control strategies.
Component Performance
- Fatigue Life
- Tribological Properties

Surface Textures
- Roughness, Waviness, Lay

Chip Formation, Forces, Tool Wear

Surface Integrity
- Microstructural Changes
- Residual Stresses, Hardness

Cutting Conditions
- Speed, Feed, Depth of Cut

Tool Geometry
- Rake Angle, Nose Radius, Edge Prep

Material
- Workpiece/Tool Props., Workpiece Microstructure
Project Presentations

- Stephen Smith, PhD student: "Performance Characteristics of Hard Turned Surfaces"

- Ty Dawson, PhD student: "Effect of Cutting Parameters and Tool Wear in Hard Turning"

Others (Poster):

- Anand Ramesh, PhD student: "Finite Element Modeling of Hard Machining Processes"
Project Title:

*Enabling Technologies for Lean Manufacturing of Hardened Steel Applications*

Joint Venture Partners:
- Delphi Automotive Systems
- Torrington Co.
- Georgia Tech
- Hardinge Inc.
- Kennametal
- Third Wave Systems
- Masco Tech
- Ohio State Univ.

Total Project Value: $11,747K

Project Duration: 4 years, Starting Oct. 1, 2000
NIST ATP - Objectives

- development of predictive models of the hard turning and precision forming mechanics, part quality, and integrity
- development of new tooling and fixturing technologies
- development of process monitoring and control of part quality, integrity, and tool life
- design and development of advanced machine tool technology
- development of an integrated lean manufacturing cell
- comprehensive process and product validation of the integrated system
NIST ATP - Expected Highlights

- Systems approach to the solution of problem manufacture of hardened steel components
- Hard turning process simulation software
- Advances in machine, cutting tool, and workholding design
- Advances in part quality sensing monitoring technology
- Accelerate use of hard turning technology in functionally-critical applications