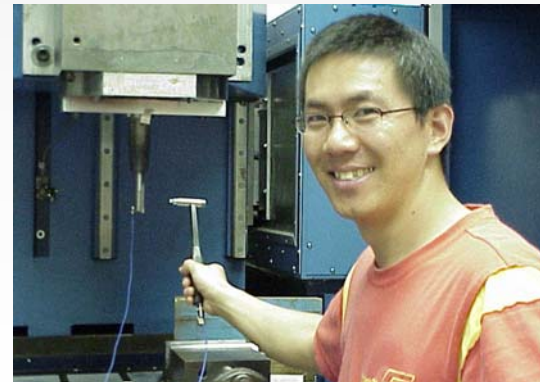
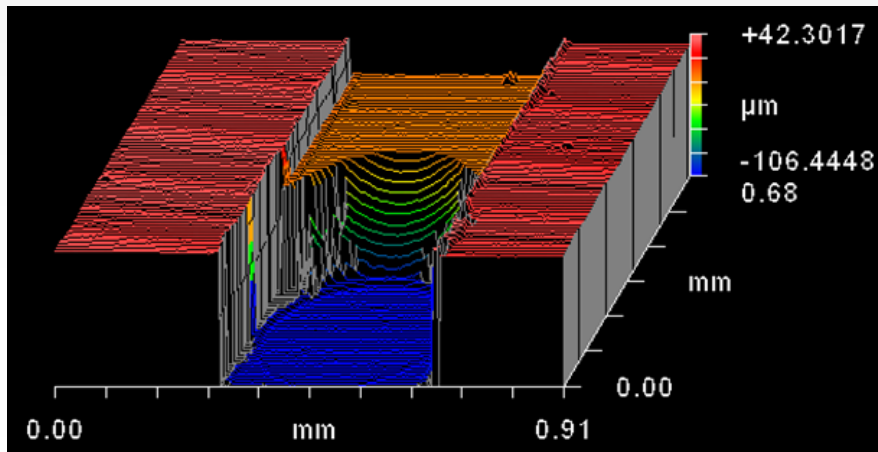


Manufacturing process modeling and metrology

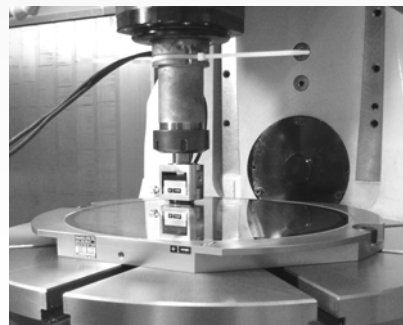
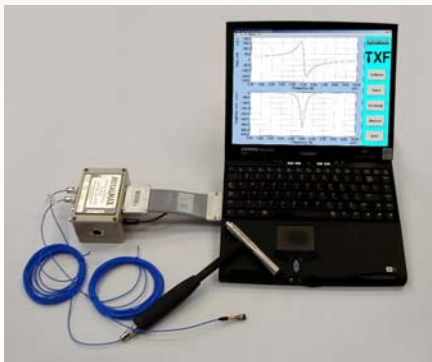
Tony L. Schmitz

Department of Mechanical and Aerospace Engineering
University of Florida, Gainesville, FL



Machine Tool Research Center

- Founded in 1984 by Dr. George Tlusty
- 26 PhDs graduated
- 60 MS degrees awarded
- Over \$12M in externally sponsored research from government and private industry
- Over 2300 ft² lab space
- State of the art machine tools, metrology equipment, instrumentation



High-speed machining research

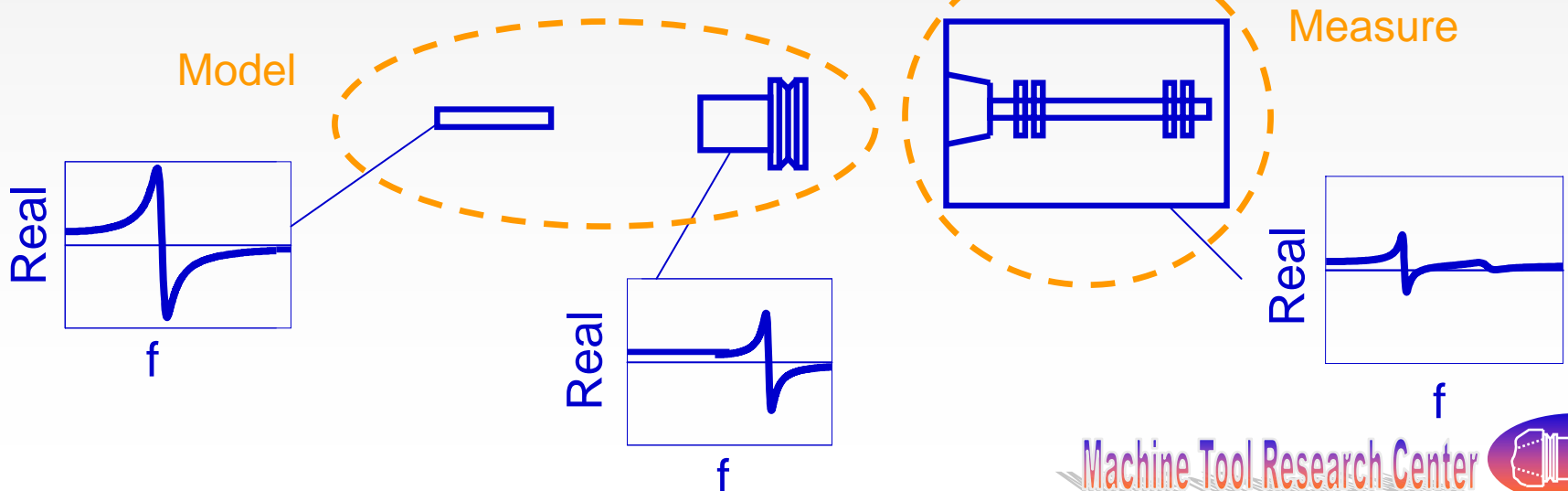
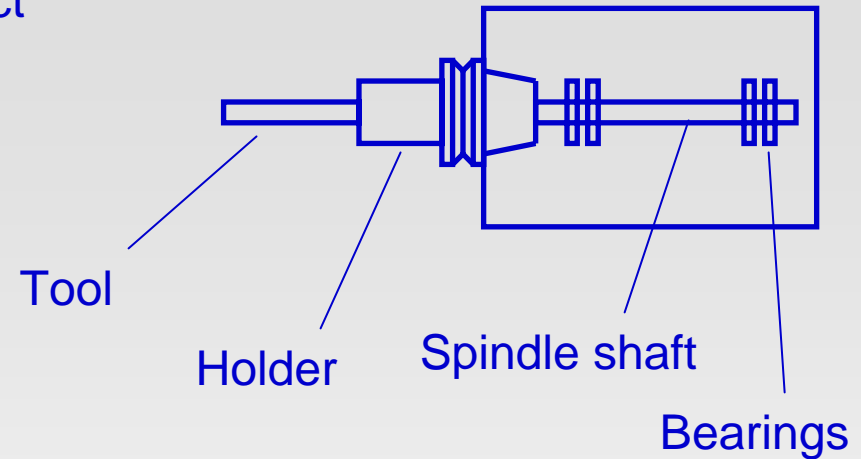
Stability lobe diagrams can be used to select cutting conditions to avoid chatter.

This requires knowledge of the tool point dynamic response.

Can measure using impact testing, but requires hardware and expertise.

Alternative: model the tool-holder-spindle assembly.

Each component has its own response – the combination gives the assembly response.

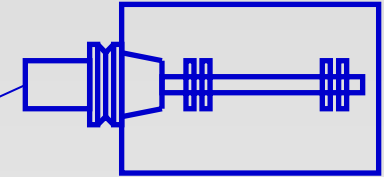


High-speed machining research

Our approach

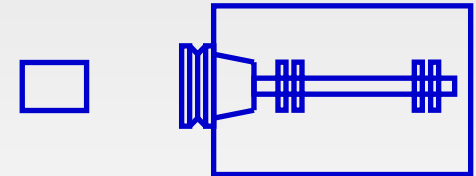
- insert standard holder in spindle under test

standard holder



- measure response of standard holder-spindle by impact testing (service provider, archive, include as part of maintenance program)

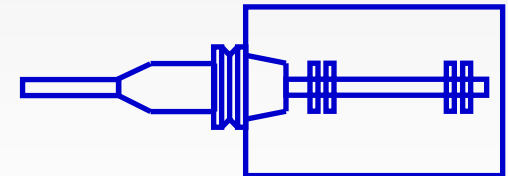
- remove portion of standard holder beyond flange (in simulation) to isolate spindle



- model desired tool-holder



- couple tool-holder receptance (FRF) to spindle response



- predict tool point FRF (virtual impact test)

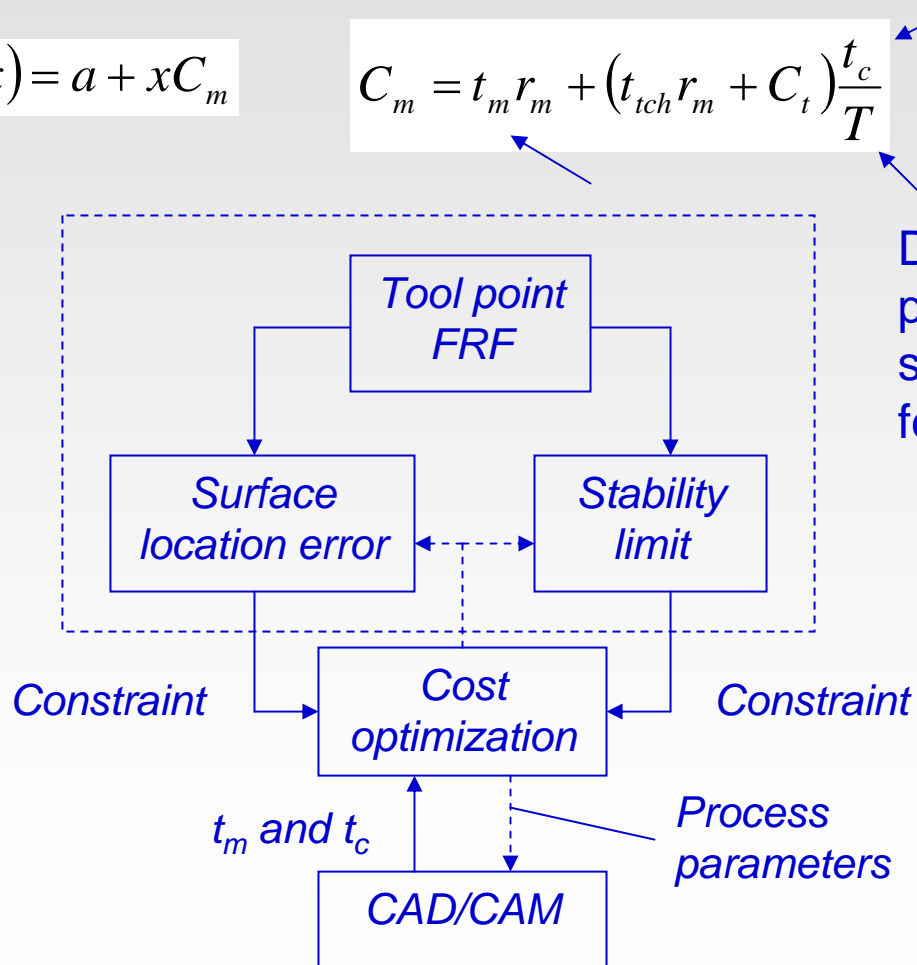
High-speed machining research

Single objective function, cost-based optimization formulation. Consider both process dynamics and tool wear.

$$C(x) = a + xC_m$$

$$C_m = t_m r_m + (t_{tch} r_m + C_t) \frac{t_c}{T}$$

All analytical,
frequency
domain models.

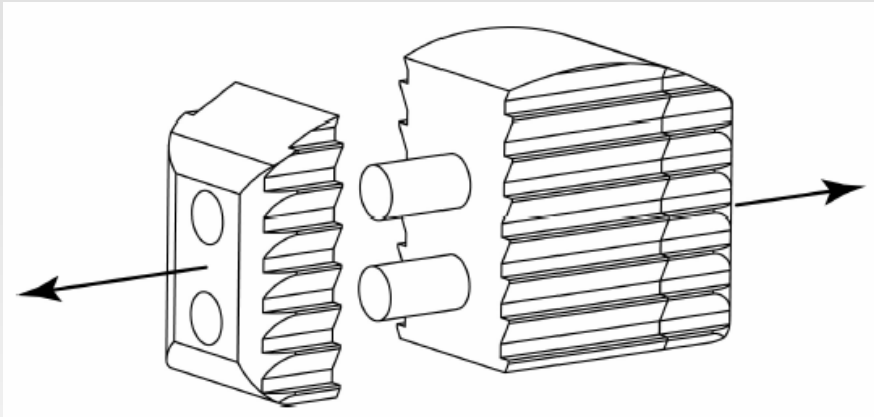


Depend on process
parameters (spindle
speed, depths of cut,
feed/tooth)

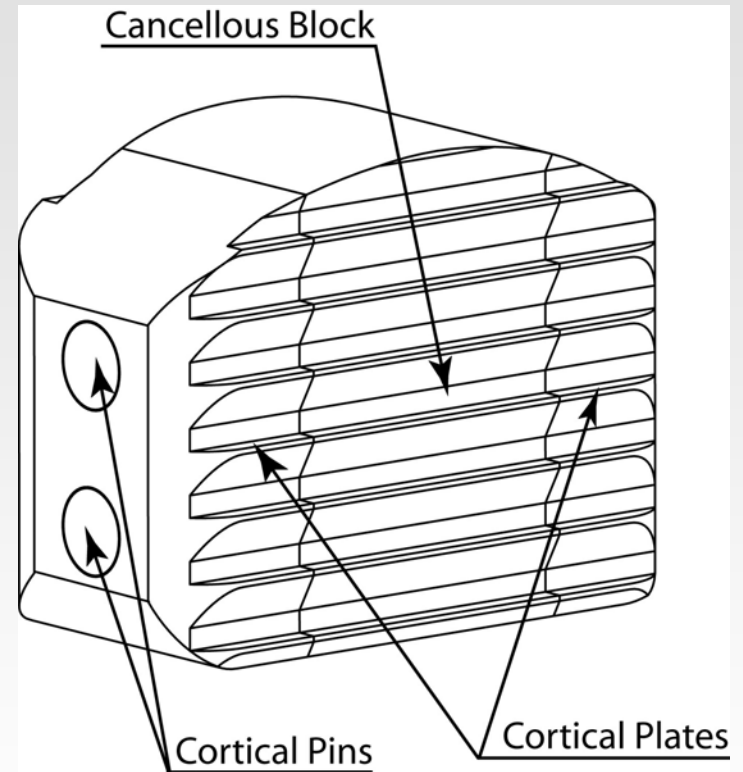


Manufacturing metrology research

Example: Determine error sources for interference pin connection in human bone allograft for spinal fusion.



Measured components at process stages.
Determined interference from dimensions.
Developed finite element model.
Completed Monte Carlo simulation.
Made recommendations for process improvements.



Web site for more information

<http://highspeedmachining.mae.ufl.edu>

- Publications
- Presentations

UF High-Speed Machining - Microsoft Internet Explorer


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Welcome to
**High-Speed Machining:
Machinist Online**

Research principal investigator: [Dr. Tony Schmitz](#)
University of Florida [Machine Tool Research Center](#)

Click to access the [Machinist Online](#)



Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation, Office of Naval Research, or Naval Surface Warfare Center Carderock Division.

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Address <http://highspeedmachining.mae.ufl.edu/parameterselection.html>

Holder Description

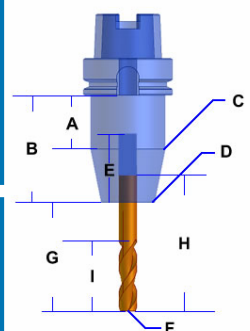
48 length to taper [mm] (A)
101 total length [mm] (B)
41 body diameter [mm] (C)
33 end diameter [mm] (D)
62 bore depth [mm] (E)

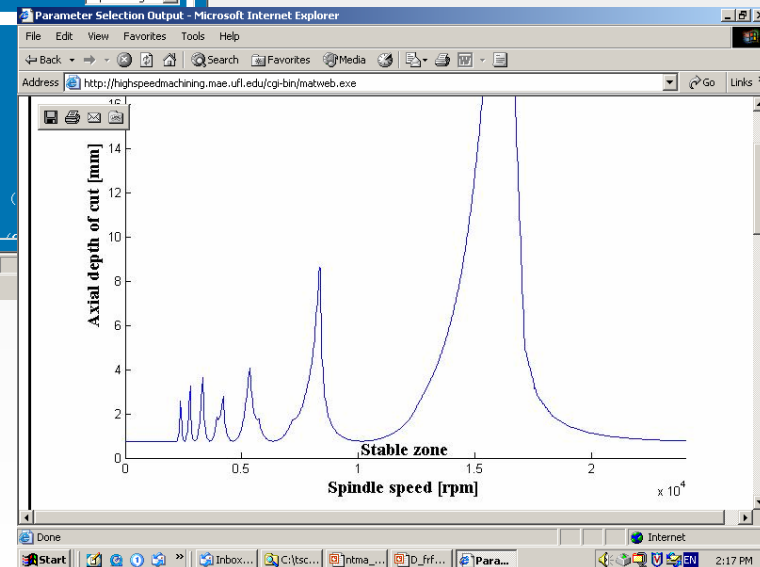
Milling Description

radial depth [mm] 5
chip load [mm/tooth] 0.1
direction [dropdown]
Up milling [dropdown]

Spindle Selection

Demo spindle [dropdown]
24000 max spindle speed [rpm]
24 max spindle power [kW]





Pigskin Professor
video series

