

PHM for machine capability

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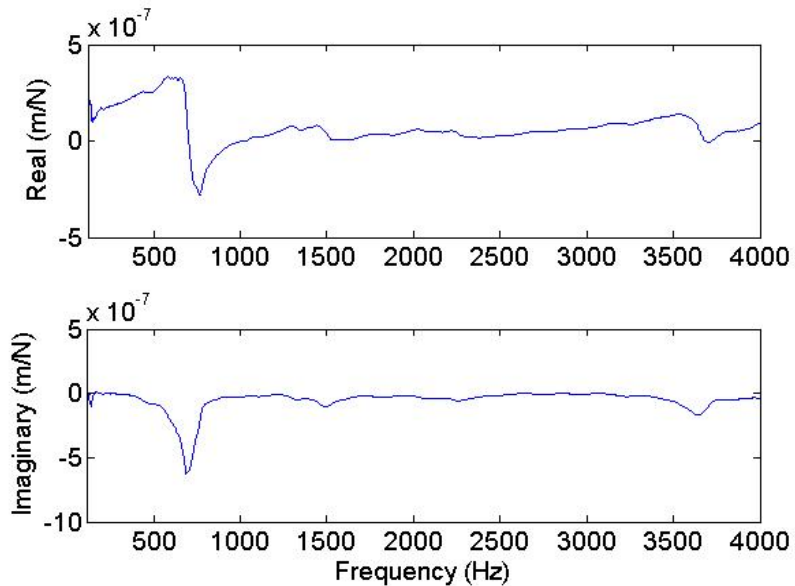
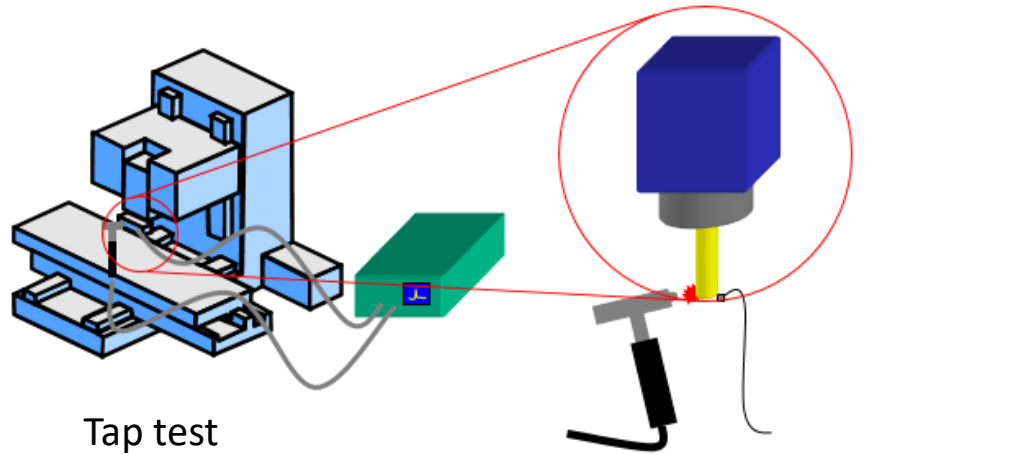
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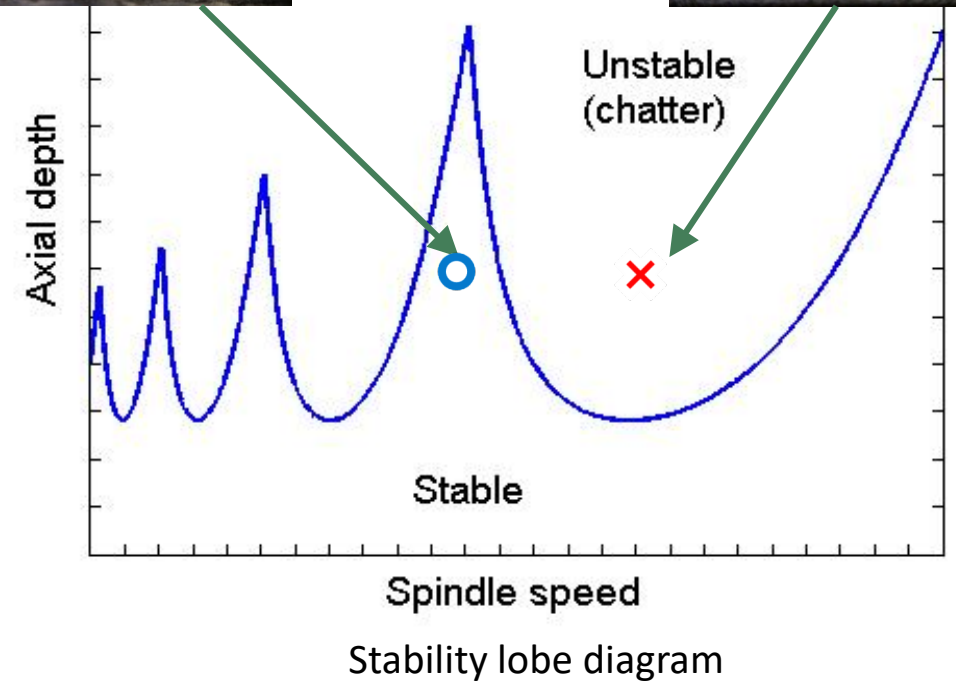


Are all my
machines
equally
capable?

Machining dynamics



Frequency response function



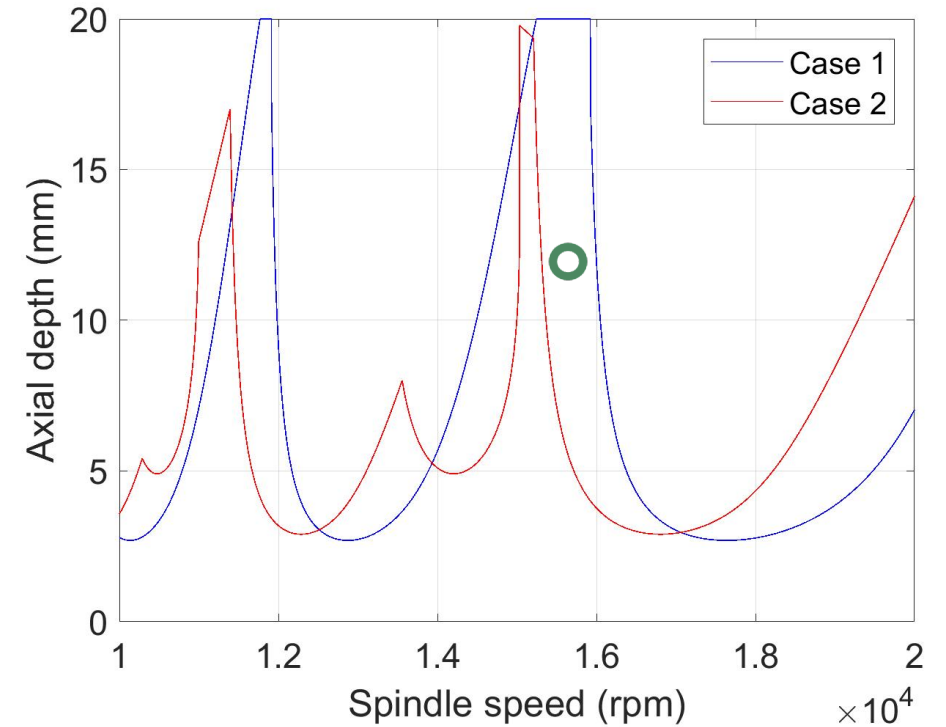
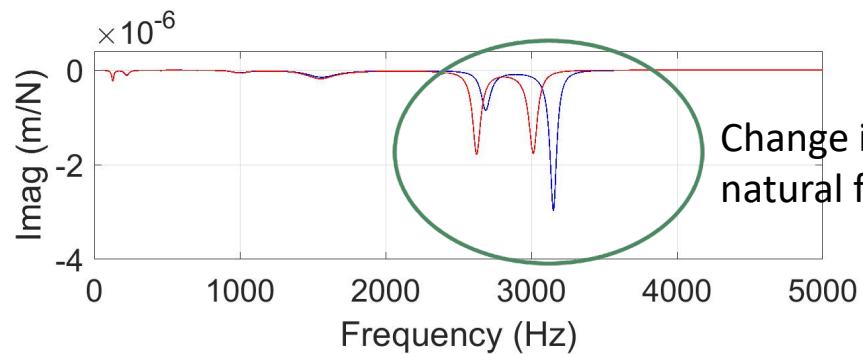
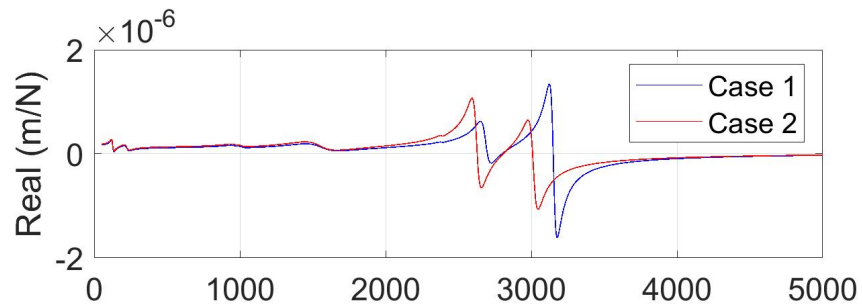
Identical machines? Different dynamics



Case 1



Case 2



Stable cutting conditions for one machine – unstable for other

Identical machines? Different dynamics

- Machine spindle dynamics depend on:
 - drawbar force
 - retention knob
 - spindle bearing pre-load
- Identical machines may start with different dynamics and they change over time.
- Process parameters converge towards the worst machine.

Machine capability

If a good program stops working:

- excessive tool wear/tool breakages
- machining chatter
- recuts and rework
- part quality

Something is wrong – it is a maintenance issue and not a normal condition.

PHM needs for machine capability

- Monitor machine health for process capability:
 - spindle dynamics
 - machine axis errors
- Model machine health in terms of process capability and part quality:
 - recommend corrective actions
 - optimized and defect-free machining process

Thank you!

Acknowledgements:

Scott Smith (ORNL)

Tony Schmitz (ORNL/UTK)