AdvantEdge Production Module™

THIRD WAVE SYSTEMS

Optimize Your Machining Process

PRISM Co., Ltd.
THIRD WAVE SYSTEMS

Company Overview
Company Profile

• Offers material-based machining modeling software and service solutions

• Offices in Minneapolis; Detroit; East Hartford, CT; Tacoma, WA; and UK

• Distributors and customers worldwide

• Korea → PRISM (Master Distributor)
Customer Profile

Aerospace, Tooling, Automotive, and Defense companies who want:

- Reduced Design Cycle
- Reduced Machining Cycle Time
- Improve Part Quality
- Reduce Tooling Costs
Global Presence

Ford Motor Company

GE Aviation

SANDVIK Coromant

DELPHI

Powertrain

BOEING

VOLVO Aero

KENNAMETAL

THIRD WAVE SYSTEMS
Global Presence
Global Presence

MITSUBISHI ELECTRIC

SUMITOMO ELECTRIC

NACHI-FUJIKOSHI CORP.

HITACHI

Canon

DENSO

MAZDA

YAMAHA

HONDA

IHI

THIRD WAVE SYSTEMS

NISSAN

XTOKUDA

PRISM
Global Presence

- Yamaha Marine Co., Ltd.
- Fuji Heavy Industries Ltd.
- Mitsubishi Materials
- Tungaloy
- Aisin
- Geared up for the future
- Toyota
- Mitsubishi Heavy Industries, Ltd.
- Kobelco
- Toto
- Toshiba
- Third Wave Systems
AdvantEdge™ Product Suite

AdvantEdge™ FEM:
- Micro/Detailed Cutting Tool Analysis
- Forces, Temperature, Heat Flow
- Chip Formation
- Tool Stresses
- Workpiece Residual Stress

Production Module 3D:
- Macro/Process Level Analysis
- Load Balancing
- Cycle Time Reduction
- Maximize Machine Utilization
- NC Program Optimization

Third Wave Systems
Analysis Not Available in CAM

- Physics Based Modeling
- Predict Tool Loads
- Predict Tool Temperatures
- Identify Unstable Cutting Conditions (Chatter)
- Automated SPEED and FEED Optimization
- Power, Force based Optimization
Optimize Your Machining Process

Design

Generate NC Code

Download NC code

NC Code

Optimized NC Code

Production Module

THIRD WAVE SYSTEMS
Optimize Your Machining Process

Tool Loads are Balanced

Cycle Time is Reduced
Optimization Process

Analysis Current Machining Process
- Machine / Controller Set up
- Specify Tool list
- Enter Workpiece Geometry
- Specify Tool Path (import current NC code)
- Run Force Model

Optimization
- Automatic / Custom NC optimization
- Run Force Model
  (Analysis Optimized Machining Process)
- Compare result

Final Optimized NC code export
1. Machine / Controller Setup

- 5 Axis Machine Tool Setup
- Power and Torque Curves
- Controller library
- User Define Controller & Machine
- Stability data and Metal Max import
2. Specify Tool List

- Setup All Tool Changes:
  - Solid End Mill
  - Indexable Mill
  - Tapered End Mill
  - Stacked Indexable Mill
  - Twist Drill
  - Indexable Drill
  - Custom Drill
  - STL / STEP Tool import
3. Enter Workpiece Geometry

- STL / STEP import
- Rectangular / Cylinder
- Composite
- Choose from Standard Library of Over 100 Materials (Tested)
- User Defined Material
4. Specify Tool Path

- Import NC program
  - CLS, APT, and G Code
5. Run Force Model Result (1)

- Graph Result
- Time / Position
- Operating Condition
  - RPM, Surface Speed, Tangential feed, Feed Rate
- Chip Geometry
  - Depth of Cut, Area of Material Removal
  - Feed/Tooth, Chip Load, Material Removal Rate
5. Run Force Model Result(2)

- Instantaneous / Average Force
  - X, Y, Z Force
  - XY, XYZ Result Force
  - Spindle Power / Torque
  - Tangential Force
  - Radial / Axial Force
  - X, Y Feed Motor Power
  - Load per Length

- Tool Cutting Condition
  - Peak Tool Temperature
  - Tool Pressure
6. Multi Sequence Optimization

- Optimize In-Cut / Air-Cut / Both
- Individual Variable setup for each Sequence
- Min/Max Feedrate for each Sequence
- Keywords for each Sequence
7. Optimization Review

- NC Code optimization & Save
- Automatic Force Model Run
7. Optimization Result

- Tool Loads Computed for New NC Program
- Display Original and Optimized Results
- Study Process Changes Based on Production Module Optimization

Tool Loads are Balanced
Cycle Time is Reduced
7. Optimization Result
7. Optimization Result (avi)
8. Turning Example
Case Study
Aerospace Component
Problem 1

Forged Titanium Component

• Tool Chipping
  – Part Scrapping
  – Line Shut down
  – Management is Angry 😞

• Solution: Reduce Feed Rate
  – Now... Cost, Cycle time too much
  – Management is Angry 😞

• Help!
Problem 2

Current order
- 5 Machines / 100 parts / 3 Month

New order
- 150 parts / quarter

New Plan
- Buying 5 new machines
- Cut 10 parts each machine
- Each Machine price about $800,000
Forged Part Geometry

- ¼ model
- Pocket machining
- 12 times repeat
Mission

• Tool chipping prevent
  - Maximum cutting force without fear of chipping is 1,850 lbf (by manufacturing history)
• Reduce cutting time
• Tool temperature limit is 1300°F
• Feed / Tooth is 0.020”
Road Balancing

Increase Cutting Forces in low areas

How? → Increase the feed rate
Pocket Savings Summary

- Time Savings per Pocket = 100 sec
- Time Savings on 12 Pockets = 20 min
- Time Savings (Percentage) = 43%

Not bad..

Let’s see what we can do with the rest of the part!
Savings Summary

• Average Time Savings (Percentage): 20%
• Part Cycle time reduced from 100hrs to 80 hrs
• Shop rate = $200/hour,
• For 50-Parts

$200,000
Savings Summary

SAVINGS: COMBINED OPERATING & CAPITAL EXPENDITURES

Initial Production Schedule
5 Machines
10 parts each
1,000 hours machine time
(42 days)

New Production Schedule
2 machines and 2 machines
12 parts each 13 parts each
960 hours 1,040 hours
(43 days)

SAVINGS ON ONE MACHINE TOOL
$200,000 In operating costs
$800,000 In capital equipment expenditure

$1,000,000 TOTAL SAVINGS
Conclusion

- Physical based Optimization
- Maximize Machine Utilization
- Load Balancing \(\rightarrow\) Tool life improve
- Cycle Time Reduction
- Save the Machining Cost

**Save & Optimize Your Machining Process**

THIRD WAVE SYSTEMS
Q & A
Thank you for your attention

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