Objective

- Subsystem of larger product
- 4 Roller 1 belt system (2 translational / 2 stationary)

Key Functionality
- Compactly roll silverware and napkin with low user input
- Reduces time necessary to complete silverware setting

Satisfying Customer Requirements
- All lightweight cheap material
- Simple design and method of completion

Engineering Characteristics:
- Power from motor
- Simplicity of design
- Machine efficiency
- Power consumption
- Material choices
- Weight
- Roller Strength

Constraints:
- Interface with other subsystems
- High-volume production without jamming

Physics:
Required moment less than 1 in-lb (Quantity $M_3$ in figure).

Concept Generation

Concepts:
- Prong Driven Napkin Roller
- Variable Tension Belt Roller

Satisfying Customer Requirements:
- Capable of mass production
- Low maintenance
- Accepts varying utensil types
- Price between $200-$300

Market:
Approximately 25,000 businesses in D.C. Metro area
- Fine dining - sit-in restaurants - catering companies

Customer Requirements:
- Satisfying
- All lightweight cheap material
- Simple design and method of completion
- Easy to use
- Safe
- Mobile
- Durable

Design

Prototype and Testing

- Initial design:
  - No lower rollers
  - Method of actuation

- Updated design:
  - Placement lower rollers
  - Triangular slider

Testing Functionality
- Actuator displacement
- Revolutions per fold
- Folded napkin sets/minute
- Life cycle testing
- Varying silverware and napkin sizes
- Ramp materials & angles

Results and Future Work

Summary of Design Project
- Machine design that automatically rolls silverware into napkins
- Open-ended design allows easy interface with other subsystems

Future Work: Next steps
- Create mechanism to place and fold napkins
- Create subsystem to sort and place silverware
- Take product to market
- Prototyping and testing was most valuable steps for optimizing design project, allowing design flaws to be addressed and corrected.

Process Reflection

Mechanical Engineering Design Day

Date: November 30, 2010