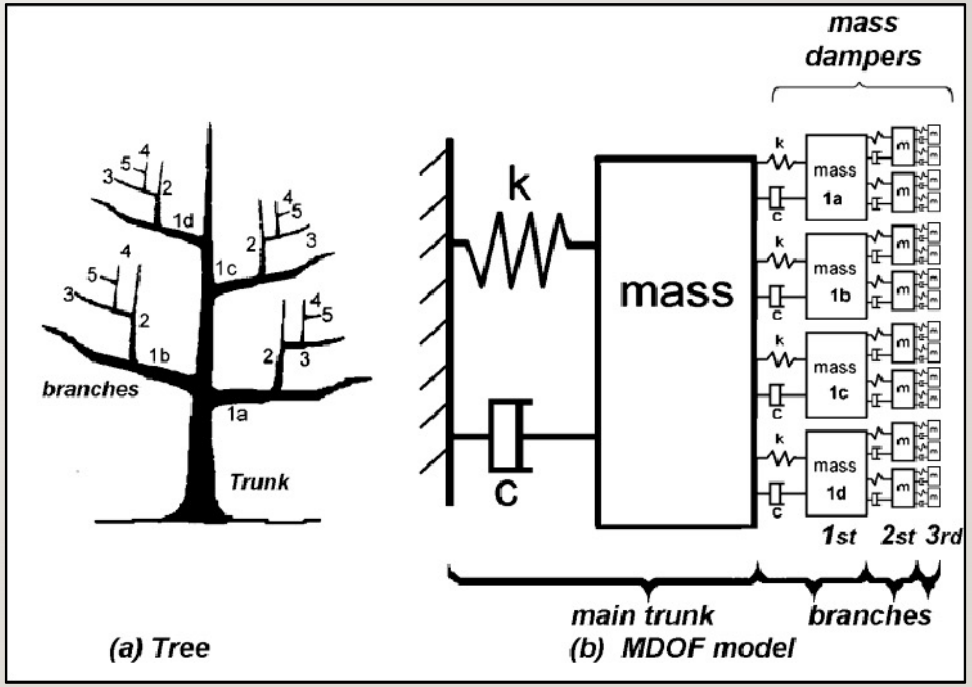
PROBLEM FORMULATION INTERNAL REVIEW

SDI T9 - MIGUEL MARTINEZ, BENJAMIN HUERTA, PAUL SILVA, JOSHUA SANCHEZ

Ripple Effect

BACKGROUND RESEARCH

- Important Topics:
  1. Mesquite Trees & Beans
  2. Frequency Response of Trees
  3. Mechanical Properties & Stability of Trees
  4. Analysis Methods
  5. Vibrating Machinery
  6. FEA Modeling
  7. Mechanical Harvesting



BACKGROUND RESEARCH

Mesquite Trees & Beans

- Tough, resilient species grows all over Texas
- Varies considerably in size
- Produces mesquite beans
- Resourceful Tree

BACKGROUND RESEARCH

Mechanical Properties of Trees

- Wood and other plant materials are viscoelastic
- Exhibit Nonlinear behavior
- Plant Responsiveness
- Behavior/Property Approximation

BACKGROUND RESEARCH

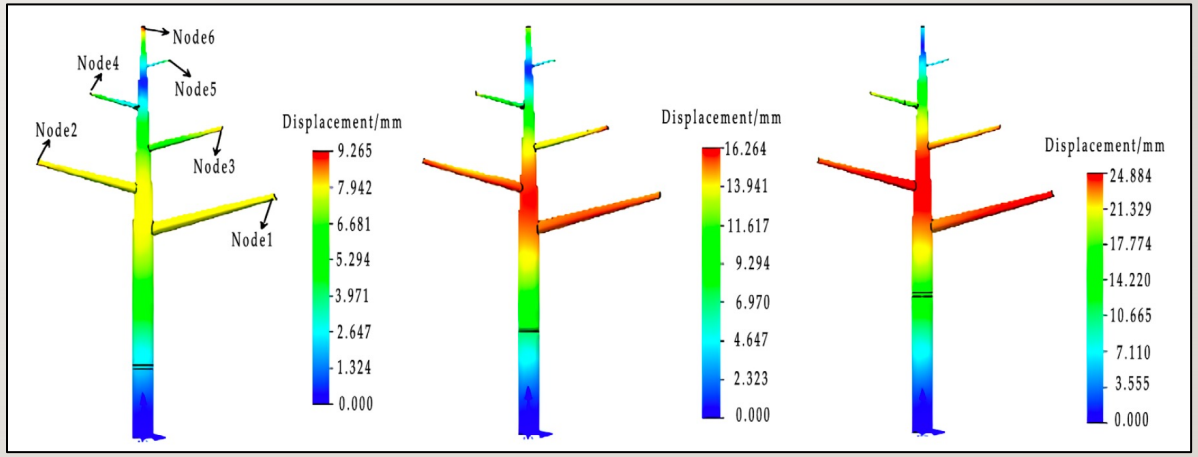
Vibration and Collection Mechanisms

- Analysis Methods
- Vibrating Machinery (Rotating Unbalance)
- Eccentric Block Pair
- Tilted Umbrella Collection System

BACKGROUND RESEARCH

FEA Modeling

- FEA Free Vibration
- Modeled dynamic behavior for hundreds of coniferous and deciduous trees.
- Wind loading and fundamental frequency
- Height & Vibration Displacement



COMPETITIVE ANALYSIS

Tractor Attachment

Shaker & Collector

Mobile Shaker

Shaker Vehicle

USER RESEARCH

- User: Mesquite Farmers from South Texas (Cappadona Ranch)

- Techniques:

→Customer interview – Meet with the owners of the ranch, inquire about their needs/wants/hopes for the final design.

- Q1 : What specific problems do you encounter while hand-picking mesquite beans?
- Q2 : Approximately how many mesquite beans are you able to harvest per season?
- Q3 : How far off is this from mass production?
- Q4 : Any health or safety concerns with current method (hand-picking)?

VALUE PROPOSITION/CUSTOMER SEGMENT

- The primary customer is the owners of the Cappadona Ranch.
- The goal is to eventually reach other mesquite farm owners.

Cappadona Ranch
LINN, TEXAS

DESIGN SPECIFICATION

- Demands (D):
  - Rotating Unbalance
  - Wireless/No-Plug (Battery-powered)
  - Size should be easily storable
  - User-friendly (no complex operating procedure)
  - Frequency Adjustment
  - Strong, flexible materials capable of withstanding heavy vibrations
  - Compact
  - Mechanical Harvester Dimensions (H): 10 ft
  - Collector Dimensions (LWH): 3, 2, 1.5 (ft)
- Wants (W):
  - Weather Resistant (Waterproof)
  - Lightweight: Mechanical Harvester (< 10 lbs.) Collector (< 100 lbs.)
  - Mechanical Harvester Price: $100 (Low cost)
  - Collector Price: $150 - $200 (Low cost)

CONCLUSION

- In the Problem Formulation stage, the team has gained valuable information relating to the task at hand through background research and competitor analysis.
- We have planned our next steps involving user research and seek to gain further insight by speaking with the potential customers directly.