OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY
FACT SHEET

MSSE Measurement Science and Systems Engineering Division

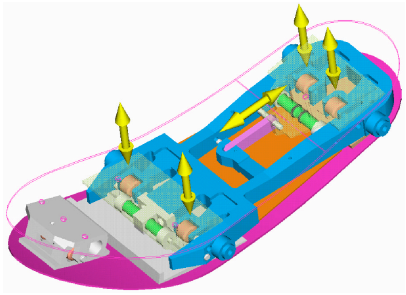
ROBOTICS AND ENERGETIC SYSTEMS RESG GROUP

Foot Force-Torque Sensor

Novel Sensor for Measuring Forces and Torques at the Foot

Technology Need

Real-time, "in-situ" (not restricted to a force plate), high accuracy, highly sensitive *measurements of the forces acting on a human foot*. Transparent to the user without compromising motion. Operates in any terrain and environment. Modular and easily integrates with other systems.



4-axis foot force-torque sensor.

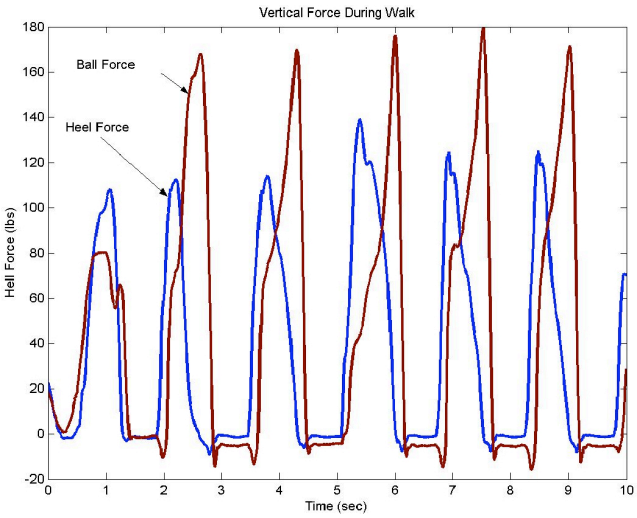
ORNL Prototype Sensor

- Provides 4-axis measurements
- Test results matches published force plate data
- Characteristics:
  - Max force: 1200 lb
  - Mass: 2.5 lb
  - Sensitivity: <0.2 lb
  - Thickness: 1.75 in
- Status: Fabricated and successfully tested (see figures).
- Developed through the DARPA Exoskeleton Program

Enhanced Prototype

- Additional sensing and a more compact design:
  - 7-axis sensor
    - Vertical forces (toe, ball of foot, and heel)
    - Lateral forces
    - Toe force
    - Moments
  - Flexible (permit normal foot flexing)
  - Thin profile (target: < 1 in)
  - Low mass (target: < 1.5 lb)
  - Attach to slightly modified boot
  - Environmentally sealed
- Status: Being developed based on results of initial prototype
- Being developed through the DARPA Exoskeleton Program

Testing of prototype.



Test Data: walking forces.

Potential Applications

- Exoskeleton
- Orthotics
- Biomechanics research
- Prosthetics

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