

Carpal-Tunnel Device

Contributor: Kenneth W. French Jr
Affiliation Address: Mechanical Engineering
John Brown University
Box 3017
Siloam Springs AR 72761
Telephone: (501) 524-7223
FAX: (501) 524-9548
e-mail: KWFJR@ENGR.JBU.EDU

Type: Design Problem
Student Time: 2 weeks
Location: In class and take home

Summary

This design problem is intended to be a highly conceptual experience with a minimum of real world constraints. A capstone version of this design concept is certainly a possibility. An important concept is the use of engineering skills for the upraising and health of mankind. Some investigation will be required into the status of carpal-tunnel syndrome research and human factors data for wrists.

ABET Descriptors

Engr Sci Content: First Year Engineering
Type: Device concept
Elements: Conceptualization, space layout, descriptive reporting
Features: Brain-storming, human factors, litigation driven, safety, fatigue, ethical aspects of design
Constraints: Release from as many constraints as possible, criteria - most innovative
Effort: Individual

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Description:

Design to the conceptual stage a tester for human wrists that indicates the predisposition of the tested individual to incurring the Carpal-Tunnel syndrome in a repetitive work environment.

Background:

The Carpal-Tunnel syndrome debilitation is very common in certain descriptions of manufacturing or processing plant work. Apparently some humans are predisposed to the condition while others can work for many years without showing signs of its development. The company response is either to terminate or find other employment for an injured worker. However there are very few of the low level jobs that a C-T person can perform. Rumor has it that workers with validated injuries are paid a set compensation and released from employment.

Challenge:

Be Brave and Creative; state your assumptions explicitly. There are many individuals with the above mentioned predisposition, and you should suggest in some detail how you will calibrate your machine using that resource. Your device could save a great deal of unnecessary agony for workers at the lowest level of employment and in addition could save the a wide variety of manufacturers from an expensive, awkward and perhaps occasionally embarrassing human relations problem.

Extent of Effort:

Two weeks from today submit a written report describing your design. The report should contain about 250 words of text and 3 figures including an isometric overall view and a schematic.

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Engineering Notes:

This project may be initially frightening to the students and hence you will not get a response until you have given a “warm-up” talk about what “carpal-tunnel” syndrome is and its pertinence to society. It is important to emphasize to the students that their limited ability to analyze should not hold back their design; “we will hire a consulting company to complete the detailed design”.

As ideas start to appear and blossom it is of course important to nourish them all, but especially those that seem ‘off-the-wall’ or trivial. Evaluation by peers must be curtailed by the instructor or the flow of new ideas will soon dry up, and you will find yourself grading ‘n’ versions of the same design concept.

Some ideas may need to be provided for features of the carpal tunnel; of course the great majority of the students are ‘owner-operator’ of a wrist which gives the class an immediate access to a range of similarities and dissimilarities in wrist parameters. Ideas that come immediately to mind to be thrown out as ‘seed corn’ are:

- 1) the range of motion allowed with a certain applied torque.
- 2) the sonic character of a movement of the wrist through a characteristic range
- 3) human feedback about pain during motion
- 4) machine driven repetition with measured force vs cycles

Four in-class sessions of about (15,5,5,10) minutes should be used to initialize, track, empower and terminate the project.

This project would lend itself immediately to implementation in courses in Machine Design or Capstone Design.

carpus:

1. The group of eight bones forming the joint between the forearm and the hand.
Also called wrist.
2. A joint in quadrupeds corresponding to the wrist.

carpal:

1. Of, relating to, or near the carpus. A bone of the carpus.

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tunnel:

- 1. An underground or underwater passage.**
- 2. A passage through or under a barrier.**
- 3. Obsolete except in Tennessee; The main flue on a chimney .**