Flexures Poster Project
ME 325

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The goal behind our flexure poster was simple, to create a poster that explained basic information about flexures, the advantages of using flexures over other kinds of joints and basic procedures for analyzing flexures.

Since many junior engineers may have never used flexures before, we started by finding basic information about what flexures are and how they behave. The first step was to simply define flexures. Flexures are joints connecting solid members and permitting relative motion in some directions while constraining motion in others. This step proved to be much more difficult then we had intended. Basic Google searches gave results for flexure of beams (and although flexures do buckle and deflect they behave differently then a truss that has deflection) The searches also resulted in complicated flexure systems either really small (the size of a match) or the size used in race cars, which did not seem to satisfy the direction that we wanted to take with this particular poster.
To keep the poster simplistic, we deicide to that drawn generalizations of flexures would be more beneficial to our poster rather than actual photographs. These schematics allowed us to display diagrams that clearly defined coordinate systems as they applies to stiffness calculations, but more importantly, these schematics make it easier to visualize the way in which flexures work. Showing the equivalent bar arrangement for an ideal flexure sheet, we added a diagram that helps relate flexure to a joint system more engineers are familiar with.

After informing of the basics of what flexures are we decide that we wanted to include reasons why an engineer would choose to use flexures. Our research yielded many unique properties that would be advantageous for design. Some of the properties of flexures that were found include: both friction and stiction are not measurable in flexures, flexures contain high stiffness, flexures do not have internal friction, they hold relatively high load capacity, they are resistant to shock, they have low sensitivity to vibration, they see an absence of wear, and they do not allow for mechanical play.

Even with excellent physical properties flexures are not the best device for every application, so we felt that it would be beneficial to list a couple of real world systems that have flexures. The main applications of flexures that we found include applications in: nanotechnologies, high performance vehicles and measurement devices. We felt that including information on when not to use flexures would also be useful. Consequently, a section of our poster is dedicated to giving general tips of how to use and not to use flexures, as well as adding a couple pictures of flexures being used in a non-optimal application.

Finally we wanted to include information on how to analyze ideal sheet flexures. The equations on the poster are two of the key equations that we where able to find, one for the stiffness in the x direction and the other for stiffness in the z direction (looking at the diagram that correspond to the equation the deflection in the y would be minimal because of the geometry of the flexure). Other research (including an internet search, the Shigley Mischke, and Gere books) gave only equation on how to estimate the deflection based on treating the flexure as a column, and since columns where given to another group we left that information off of this particular poster.