

Final Project

Design and Simulation using SUGAR

Objectives:

1. To experience an introduction to the process of MEMS design and simulation.
2. To learn about the SUGAR simulation environment and use it on a problem.
3. To learn how to do MEMS design at a level of abstraction other than physical layout level.

Preliminaries:

1. Download the latest version (3.1) of SUGAR and install it as per instructions. Note that you must have a full MATLAB ver 6.5 to install and run SUGAR.
2. Print the user guide (ver. 3.0) that can be found in the "manual" sub-directory of the downloaded package. The source for the manual is also there (TeX files).
3. While reading Chapter 4 of the manual run the examples yourself and make sure that things work on your local installation.

Project Work:

1. Download and read the paper titled "Micromechanical Digital to Analog Converters of displacement for step motion actuators" Journal MEMS, vol. 9, no. 2, June 2000.
2. Write a two printed page critical review of the paper. A critical review should include an introduction, description of work done and summary of results. In addition it should have your commentary on the paper.
3. Produce a SUGAR deck for the four structures in Figure 5 and verify using a SUGAR simulation that the compliance of the composite structures is indeed what the authors claim (do a static D.C. analysis).
4. Visualize the results and plot the data.

EXTRA WORK:

1. Produce a SUGAR deck for a 2 bits A/D converter. Make sure that you employ the hierarchical description features of SUGAR. I.e. do not make a flat description of the structure.
2. Use the visualization module in SUGAR to visualize the design.
3. Use the static operating point analysis of SUGAR to obtain the static characteristics as depicted in Figure 9. Use the "mumps.net"
4. Document your work in a three page report that includes sample figures and simulation results. Note that every bit represented in the graph corresponds to an application of a 150 V voltage.

5. Modify your design to adhere to the Cronus MUMPS process and repeat the simulation. If there are good designs, the SUGAR deck can be converted directly to a CIF layout file and we will submit it for fabrication.

Bibliography:

1. SUGAR, <http://www-bsac.eecs.berkeley.edu/cadtools/sugar/sugar/> for information and <http://sourceforge.net/projects/mems/> for downloading the latest version.

Written Report:

You can work in groups of 3 or 4 people to do the project. However the written report must be done on your own from notes and data that you have taken as a result of the group activity. Please write on your report the name of the group partners.

Project prepared by A.G. Andreou, Spring 2003