SISP 1313 Introduction to Computer-aided Design and Manufacturing

Course Description
This short course is intended for highschool students. It will teach some fundamental theories and technologies in computer-aided design and manufacturing (CAD/CAM). After taking this course, students will have a basic understanding of how today a product such as i-phone6’s frame is designed on a computer and how it is machined on a numerical controlled (NC) machine. The teaching will be centered on hands-on labs: after an initial introduction of basic theories, students will learn how to use a commercial CAD software to design a product such as i-phone6’s frame, how to write a NC program for machining it, and finally physically operate a 5-axis NC machine tool to execute the NC program to machine it. The students are expected to be fascinated by how computer is used in design and manufacturing and further on inspired to pursue a proud career in engineering.

Topics and schedule
The course will last 9 days, each day 2 hours.
Day 1: Fundamental theories of curves and surfaces in CAD. (Lecture)
Day 2: Learn MATLAB. (Lab)
Day 3: Write MATLAB program to implement some types of curves taught on Day 1. (Lab)
Day 4: Learn CAD software SolidWorks; use it to design a simple part such as i-phone6’s frame. (Lab)
Day 5: Fundamental theories of numerical machining. (Lecture)
Day 6: Learn CAM software SurfMill and write NC program for machining the part that you have designed on Day 4. (Lab)
Day 7: Learn how to operate a 5-axis NC machine; execute the NC program that you have written on Day 6 on the 5-axis NC machine and watch how the produce is machined. (Lab)
Day 8: (1) Final written assessment (1 hr)
(2) Class discussion on the projects from Day 7; demonstration of the best project; free discussion on any topics, such as what you have learnt, what you now think of design and manufacturing, what major or career you want to pursue after highschool, etc.
(Note: there is a day break between Day 7 and Day 8. The Lab will be open for those students who have not finished their projects on Day 7 or simply want to do more NC machining projects.)

Grading Scheme
- In-class Exercises (30%)
- Lab Projects (70%)

[Topics and grading schemes are subject to change as deemed appropriate. Students will receive information and guidelines in class on how they will be assessed for the course.]

Instructor
Prof Kai TANG
After being awarded BSE in Mechanical Engineering from the Nanjing Institute of Technology (now Southeast University) in 1982, Prof Tang was among the first sponsored by the Education Ministry of China to study in the University of Michigan (Ann Arbor), where he received his MSc and PhD awards in
Computer Engineering in 1986 and 1990 respectively. While studying at Michigan, he worked part-time as a computer programmer at Ford and Chrysler. From 1991 to 2001, he was a software specialist at Schlumberger CAD/CAM (which in 1994 became Applicon and in 1999 became part of Unigraphics). Among his various responsibilities and projects, Prof Tang was one of the chief architects of the multi-axis NC surface machining software BravoNC; he also led a team that developed an ACIS-based geometric engine for 5-axis tool path computation. Prof Tang had also worked for a short period of one year in 2000 as the chief engineer in a start-up company focusing on voice recognition technology. In July 2001, he joined the faculty of the Department of Mechanical Engineering (now Department of Mechanical and Aerospace Engineering) at HKUST and became Full Professor in 2011. Prof Tang’s research interests are broad, but most concentrating on developing efficient and practical algorithms in mechanical Computer-aided Design and Manufacturing. Aside from his regular professional research and teaching in academic, Prof Tang is also an avid writer. Prof Tang has been teaching for the HKUST Summer Institute since 2011 and his course has been among the most popular in the program.