Research topics for graduate students for 2023

Professor Naohiko Sugita

Department of Mechanical Engineering

Acceptable course(s)

➢ Master's Degree

➢ Doctoral Degree

Research Topics

Our research aims to develop state-of-the-art production technology, machine tools, laser processing, and medical application technology, applying them to various cutting-edge fields. Specifically, we focus on the following three areas: (1) cutting/grinding and machine tools, (2) laser processing, and (3) medical applications.

1. Cutting/Grinding and Machine Tools

Our targets are high-precision and high-efficiency machining technologies for difficult-to-machine materials. Also, we are developing a machining center with carbon fiber reinforced plastic, a composite material, as the main structure. We have already developed a simultaneous 5-axis machining center.

2. Laser processing

Microfabrication of glass using ultrashort pulsed lasers is main objective. We have proposed a new processing method based on ultrafast observation of phenomena with the pump-probe method. We are extending the proposed method to welding, slotting, and processing of ceramics.

3. Medical application

The methods to design knee prostheses for individual patients are ongoing, using FEM simulations and muscle-skeleton models to predict the behavior of knee prostheses after surgery. Based on the simulation results, we also propose new knee joint prosthesis geometries.

Articles Related to Research Topics

[1] Structural components with sensing capability of three-dimensional temperature distribution for thermal deformation prediction. Precision Engineering, 75, 153−166. https://doi.org/10.1016/j.precisioneng.2021.12.010.

[2] Ultrafast and large-gap microwelding of glass substrates by selective absorption of continuous-wave laser into transiently excited electrons. CIRP Annals. https://doi.org/10.1016/j.cirp.2022.03.003

[3] Multiscale finite element musculoskeletal model for intact knee dynamics. Computers in Biology and Medicine, 141, 105023. https://doi.org/10.1016/j.compbiomed.2021.105023

Lab. Web page: https://www.mfg.t.u-tokyo.ac.jp