Book of Abstracts

The Louis Stokes Alliances for Minority Participation Program

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Design and Prototyping of a Speed Reducer GearBox
Sheikh Ahmar
Prof. Angran Xiao

In this project, the student in the Department of Mechanical Engineering Technology will study and create CAD models and technical drawings of a speed reducing gearbox. Students in this project will learn Design for Manufacturing, CAD, AutoCAD and SolidWorks.

Defining Practices to Mitigate the Effects of Orbital Debris in Space
Caroline Eco
Prof. Mohammad Razani

In 1994, the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) first recognized matters related to orbital debris in space. Orbital debris, or space debris, includes all human-made space objects orbiting Earth that is no longer functional. This includes spacecraft, launch vehicle upper stages and fragments from old satellites. In July 2008, the number of orbital debris greater than 10 cm in size were 18,000 and orbital debris greater than 1 mm in size was estimated to be more than tens of millions. Due to the demands of outer space operations, orbital debris is an inevitable consequence of all space activities. As of September 2018, the United States Department of Defense tracks about 20,000 space objects floating on the Earth's orbit. The amount space debris is projected to increase dramatically as better sensors that can detect smaller objects are developed. Orbital debris presents a growing concern to space organizations and commercial satellite operators. The operation of a space station or a spacecraft is negatively affected by orbital debris. Debris collisions cause damages that lead to the loss of a mission and/or loss of life. Depending on the orbit, even small debris are catastrophic due to high relative velocities ranging from 1-14 km/s. Path and vision blockages caused by orbital debris severely affects the efficiency of a mission. Debris can also be lethal to people and property on ground if it survives a re-entry through the Earth's atmosphere. The purpose of this research is to define the practices on orbital debris mitigation by a careful analysis of the guidelines set by the Inter-Agency Space Debris Coordination Committee (IADC) and the Scientific and Technical Subcommittee of the UNCOPOUS. This study aims to present the key requirements that these organizations have provided to space organizations to mitigate orbital debris such as: better design priorities, emergency planning procedures and decommission practices for all spacecraft. The goal of the research is to construct a logical map of improvement for the practices on orbital debris mitigation. Orbital debris will continue to be a major threat to the long-term sustainability of space activities. Further research in mitigating orbital debris in space is a prudent approach to ensure the integrity of the space activities environment.

Care and Maintenance of Dental Restorations

Ibeth Erazo
Prof. Anthony Sena

Contributing to the longevity of the restoration by minimizing the effects of surface corrosion, maintaining the esthetic appearance and the smooth surface characterization, and contributing to gingival health by lessening the potential for plaque retention are the principal reasons for taking care of dental restorations. However, during oral hygiene routine procedures and prevention treatments, these desired effects are not always achieved. In many cases, the restorative materials are not identified in a patient's record leading to damage during oral hygiene performance by dental professionals. Therefore, it is important to be able to recognize the different restorative materials and employ the correct treatment protocols. Between the materials that can be most encountered in these restorations are metals, ceramics, polymers, and composites. Management of these materials during dental hygiene procedures requires an understanding of their structure and properties. The microstructure of all restorative materials is based on the chemical phases that exist within it. A simplified view of microstructures consists of a continuous and a dispersed phase, where this last one is harder than the first. Consequently, polishing agents should be softer than the natural enamel or any of the soft phases in restorative material. Besides, there are other factors to consider such as applied pressure and the size of polishing particles. The aim of this study is to attain a general knowledge regarding the unintended effects of oral hygiene and dental prophylaxis and prevention methods on restorations surfaces and identifying the structure and properties of restorative materials that put them at risk of damage.

Key words: dental restorations, dental materials, oral hygiene.

Mechanical Characterization of Nano-material Doped Polydimethylsiloxane (PDMS)

Robert Janik
Prof. Ozlem Yasar

In the field of tissue engineering, design and fabrication of precisely and spatially patterned, highly porous scaffolds/matrixes are required to guide overall shape of tissue growth and replacement. Although Rapid Prototyping fabrication techniques have been used to fabricate the scaffolds with desired design characteristics, controlling the interior architecture of the scaffolds has been a challenge due to CAD constrains. This study aims to overcome these design and fabrication limitations. In this work, research will be expanded fabrication of scaffolds which have inbuilt micro level fluidic networks/channels. These channels serve as material delivery paths to provide oxygen and nutrients for the cells. Scaffolds with inbuilt hollow channels will be obtained in layer by layer fashion to control the internal architecture. In this research, 3D printer will be used to

generate the desired nutrient delivery network molds and photolithography will be used to create the 3D scaffolds.

Response Abilities: Digital Health Literacy through Words and Images

Judeen Peters
Prof. David Lee

The COVID-19 pandemic shows the need for factual, credible health communication, as it reveals health inequalities. In this research we investigate digital health literacies with a focus on text and images. Posters, pamphlets and PSAs use visual elements to help reach populations with "low health literacy." Visual and televisual elements such as diagrams, maps, illustrations, photos and models are important 'adjuvants' for communicating scientific facts, especially for those with limited English proficiency (LEP). To learn more about multimedia health literacy, we look towards institutions that have been using a combination of words and images to explain science for over a century: science museums.