**Flattening the curve of space robotics**

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**Abstract:**

Infrastructure monitoring, inspection, repair, and replacement in space is crucial for continued usage and safety, yet it is expensive, time-consuming, and technically very challenging. New robotics technologies and artificial intelligence algorithms are potentially novel approaches that may alleviate such demanding operations using existing or novel sensing technologies. Space structures must necessarily be very light weight due to the high costs of placing robots in space. Several methods are proposed and compared to control highly flexible space robotics, where a key challenge is the presence of flexible resonant modes at frequencies so low as to reside inside typical feedback controller bandwidths. Such conditions imply the very action of sending control signals to the ultra-light weight robotics will cause structural resonance. Implementations of incrementally increasing order are offered, achieving an over ninety percent performance improvement in trajectory tracking errors, while improvement using unshaped methods merely achieve a twenty-four percent improvement in direct comparison (where the only modification is the proposed control methodology). Based on superior performance, single-sinusoidal trajectory shaping is recommended, with a corollary benefit of preparing future research into applying deterministic artificial intelligence whose current instantiation relies on single-sinusoidal, autonomous trajectory generation.

**Biography of presenting author**

Dr. Sands studied Stanford and Columbia Universities in Mechanical Engineering. He later joined the faculty of Cornell University. He received his PhD degree in 2007 from the Naval Postgraduate School in Astronautical Engineering. After one-year postdoctoral graduate studies at Columbia University, he obtained positions of increasing responsibilities culminating at Chief Academic Officer, Dean, and Associate Provost. He has published more than 50 research articles, book chapters, and books.

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