

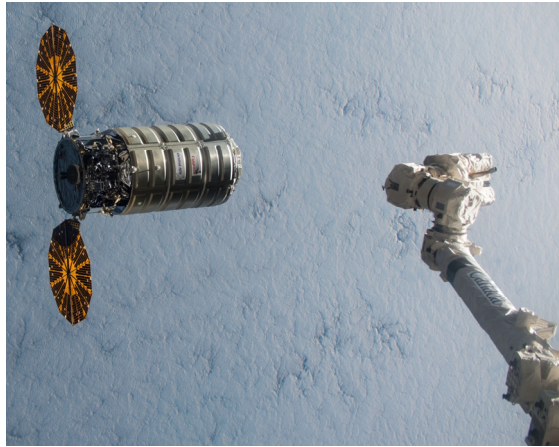


**POLITECNICO**  
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DIPARTIMENTO DI  
SCIENZE E  
TECNOLOGIE  
AEROSPAZIALI

## Onboard Navigation of Space Vehicles

*Renato Zanetti*



**Abstract** - Stochastic estimation plays an important role in various space-related applications such as orbit determination and spacecraft navigation. Many future space vehicles (such as sample and return missions to small bodies such as asteroids, landing missions to the Moon, Mars and outer planets, interplanetary exploration missions, as well as spacecraft rendezvous and proximity operations) require navigation

systems able to perform accurate and fast trajectory estimation. This talk will discuss the role of onboard estimation on NASA's spacecrafts. Particular emphasis is given to the role of consider estimation in the design and flight of onboard navigation systems. The presentation will follow the needs of actual missions such as NASA's Orion and the proposed solution using consider states. An optimal consider filter is introduced, together with the architecture and the onboard consider implementation of the Orion navigation system. Information dilution will be discussed and possible applications to orbit determination and uncertainty quantification will be briefly presented.



**Bio** - Renato Zanetti received a Laurea degree from Politecnico di Milano and a PhD from the University of Texas at Austin (UT). Renato had a ten-year professional career at Draper Laboratory and the NASA Johnson Space Center prior to joining UT as an assistant professor of Aerospace Engineering. Renato was the principal designer of the Orbital Cygnus relative navigation system and a key member and the implementer of the Orion Exploration Flight Test 1 absolute navigation system. Renato's work is mainly in the areas of nonlinear estimation, which he applies to uncertainty quantification and orbit determination; as well

as autonomous navigation of space vehicles. Renato is a Fellow of the American Astronautical Society (AAS), the Chair of the AAS Space-Flight Mechanics Technical Committee, and an Associate Fellow of AIAA.

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Sala Consiglio, 2nd Floor, Building B12, Campus Bovisa  
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