


Usman Institute of Technology

Mission Design for Satellite-Launch Vehicle (SLV)

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ST-13, Block 7, Gulshan-é-Iqbal, Abul Hasan
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Space exploration is not possible without the availability of spacecrafts, which are able to accomplish their pre-assigned mission. A firecracker is unguided and uncontrolled, whereas a satellite-launch vehicle (SLV) is guided and controlled. The talk introduced mathematical tools involved in determining, which path the spacecraft was following (navigation), which path should it follow (guidance) and how to bring it to the desired path (control). Guidance schemes and control laws are mathematical formulations of the dynamical problem. However, the problem as presented in textbooks is not sufficient to design missions. The speaker, himself involved in the practical design of the space systems, took the audience from mathematics to technology, the bridge passing through physics and engineering.

About the Speaker: Professor Dr. Syed Arif Kamal, Ex-Chairman, Department of Mathematics, University of Karachi and Convener, National Curriculum Revision Committee in Mathematics, Higher Education Commission, obtained his BSc (Honors), MSc and PhD from University of Karachi, MS from Indiana University, Bloomington, United States and MA from the Johns Hopkins University, Baltimore, United States as Quaid-é-Azam Scholar. His awards and honors include throughout First-Class-First Position and 4 gold medals for scholastic achievements. He is a member of American Institute of Aeronautics and Astronautics (AIAA), International Brain Research Organization (IBRO), the Karachi University Senate, Academic Council and Boards of Faculty. He is a referee of *Clinical Biomechanics* (Elsavir), *Proceedings of the Pakistan Academy of Sciences* and *Journal of Scientific and Industrial Research*. His research, teaching and administrative experiences in institutions of higher learning and R&D organizations span over 26 years. He has 94 papers to his credit in mathematical physics, astrodynamics, relativity, biomathematics, biophysics and algebra. Some of the main contributions are mathematical representation of sixth paradigm of physics, giving Strong Noether's Theorem, devising control laws, the extended-cross-product steering, the dot-product steering and ellipse-orientation steering, incorporating cross-range error in the Lambert scheme, introducing variable TYPE in the transfer-time equation, formulating the inverse-Lambert scheme, the inverse-Q system and the multi-stage-Q system. He has given 56 colloquia, guest lectures, presentations and seminars at various institutions of higher learning, including Air War College, the Aga Khan University, Higher Education Commission, the Abdul-Salam International Center for Theoretical Physics, Italy and Massachusetts Institute of Technology, United States. In addition, he has conducted 19 trainings as well as in-service and professional development courses. 3 of the professional development short courses were related to SLV mission design. They were conducted at Institute of Space Technology and Pakistan Space and Upper Atmosphere Research Commission (SUPARCO). During 1992-95, he served in the Control Systems Laboratories of SUPARCO. He still advises SUPARCO in its various programs, in particular, its Guidance, Navigation and Control Laboratory. His association with UIT dates back to its inception. He taught physics to computer-science students during 1995-96.

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