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IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
Lift Off - Secondary Space Education (2)

Author: Dr. Vera Mayorova
Bauman Moscow State Technical University, Russian Federation, victoria.mayorova@gmail.com

Dr. Dmitriy Grishko
Bauman Moscow State Technical University, Russian Federation, dim.gr@mail.ru
Dr. Victor Leonov
Bauman Moscow State Technical University, Russian Federation, lv@bmstu.ru

"VIVID MATHEMATICS" AS AN APPROACH TO STRENGTHENING THE RELATIONS BETWEEN SCHOOL SUBJECTS FOR FUTURE AEROSPACE ENGINEERS

Abstract

A current high school senior aimed at becoming an aerospace engineer faces the need of more deep study of STEM disciplines. Successful acquisition of such disciplines should be ensured by additional online courses, visits of laboratories at universities and direct involvement in personal projects with subsequent presentation thereof. However, our experience in practical lessons shows that even pupils at phys-math schools experience difficulties in solving interdisciplinary problems. As a general rule, this is manifested in the inability of performing an analysis of an integrated problems and its reduction to a set of standard solutions. Also, a detailed analysis will be required from future students of aerospace universities for first term projects. Hence during senior classes high schoolers have to gain skills in fast adaptation of a known material to problems with unfamiliar conditions. Mathematics is the language that links all engineering disciplines. Its study involves various forms of exercises aimed at reinforcement of previously acquired knowledge of separate fields and links between them. However, only a very small number of examples involve links with other school subjects. Pupils are taught how to solve equations and geometric problems, to plot graphs of functions. As a rule, such tasks are abstract and rarely model real-world processes (for example, solve some triangle or quadratic equation with variable "x"). To get rid of the above interdisciplinary gap, it is proposed to consider practical engineering tasks in general course of mathematics this will be referred to as "vivid" mathematics. For example, here one may consider geometric problems in evaluating the swath of a spacecraft on the spherical Earth surface or finding the sizes of inaccessible objects; a search of optimal launch angle or calculation of a target trajectory. The primary purpose of such tasks is demonstration how some or other solutions can go beyond habitual frames of its subject field. Scholars will be able to see that a problem, which at first sight seems involved and grown-up, can be solved by fairly standard mathematical machinery if one has an idea about the underlying physical principles. On an example of several standard exercises, the authors show that a problem, enriched with real-world setting, receives new colors: it becomes interesting, introduces links between abstract mathematics and real world, and can be easily remembered. As a result, associative images are formed in heads of future engineers, which later may become instrumental in finding solutions of ill-posed problems.