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“The important role of applied mathematics concepts and algorithms in the engineering education and research on circuits, signals, systems and data processing”

Abstract

During my career several concepts of applied mathematics have played a major role in my research on signal and data processing such as singular value decomposition, tensor methods, convexity, least squares and in general linear algebra. Consequently, I have introduced these concepts in electrical and computer engineering bachelor programs, and even master of AI programs. In the presentation it will be shown with examples how these concepts have been used to solve signal processing tasks like signal separation, data fusion, with appropriate algorithms. Conversely the challenges of the applications have initiated new problems at the applied mathematical level such as tensor decompositions. Moreover, strong skills in applied mathematics can bring insight how to reduce the computational complexity of conceptually strong methods for machine learning like support vector machines. Indeed, by rephrasing the problem into a least squares problem, the algorithm can be substantially reduced into solving a set of linear equations. This provides another example that good mathematical skills and training can help to reduce the computational burden, and electricity consumption of ICT, and AI methods.