ISSN: 1889-3066

Web site: jja.ujaen.es

Jaen J. Approx. 8(1) (2016), 33–58

Jaen Journal on Approximation

On tensor decomposition, sparse interpolation and Padé approximation[†]

Annie Cuyt, Wen-shin Lee and Xianglan Yang

Communicated by
F. Marcellán

Received
July 20, 2015
Accepted
May 10, 2016

Abstract

What is the connection of tensor decomposition in multilinear algebra with exponential analysis from signal processing, sparse interpolation from computer algebra, Gaussian quadrature from numerical analysis, and Padé approximation theory? These seemingly unrelated and diverse topics are nevertheless deeply intertwined, as we explain here. However, several of these connections have remained unexplored.

The various reformulations bring forth new ways to approach the problem of tensor decomposition (see Section 7) and suggestions for generalizations of existing methods (see Section 6). This may lead to important results since tensor decomposition has a number of grand applications [24], among others in chemometrics, neuroscience, computer vision, social network analysis, big data and the like.

In Section 1 we introduce the problem statement. Subsequently the connections are first established for two-dimensional tensors in the sections 2 and 3. Higher dimensional tensors are dealt with in the sections 4 and 5, with a discussion of the connections to the mentioned topics in the sections 6 and 7. We conclude in Section 8 with an illustration of the interrelationships and of our novel approach. Both the existing method presented in Section 5 and the new technique presented in Section 7 are shown.

Keywords: tensor decomposition, sparse interpolation, Gaussian integration, Padé approximation, exponential analysis.

MSC: Primary 41A55; Secondary 41A25, 42B35.

[†]This research is in part supported by an FWO project grant.