# The seriation problem in the presence of a double Fiedler value

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## Abstract

Seriation is a problem consisting of seeking the best enumeration order of a set of
units whose interrelationship is described by a bipartite graph, that is, a graph
whose nodes are partitioned in two sets and arcs only connect nodes in different
groups. An algorithm for spectral seriation based on the use of the Fiedler vector
of the Laplacian matrix associated to the problem was developed by Atkins et
al. [1], under the assumption that the Fiedler value is simple. The algorithm has
been analyzed and improved in [2].

In this talk, we analyze the case in which the Fiedler value of the Laplacian
is not simple, discuss its effect on the set of the admissible solutions, and study
possible approaches to actually perform the computation. Examples and numer-
ical experiments illustrate the effectiveness of the proposed methods.

**Keywords:** seriation problem, Fiedler vector, bipartite graph

## References

1. J. E. Atkins, E. G. Boman, and B. Hendrickson.
   A spectral algorithm for seriation and the consecutive ones problem, SIAM J. Com-
   put. 28(1), pp. 297–310, 1998.
2. A. Concas, C. Fenu, and G. Rodriguez.
   PQser: a Matlab package for spectral seriation, Numer. Algorithms, 80(3), pp. 879–
   902, 2019.