

Numerical Computing 2020 — Submission Instructions
(Please, notice that following instructions are mandatory:
submissions that don't comply with, won't be considered)

- Assignments must be submitted to iCorsi (i.e. in electronic format).
- Provide both executable package and sources (e.g. C/C++ files, Matlab). If you are using libraries, please add them in the file. Sources must be organized in directories called:

Project_number_lastname_firstname

and the file must be called:

project_number_lastname_firstname.zip

project_number_lastname_firstname.pdf

- The TAs will grade your project by reviewing your project write-up, and looking at the implementation you attempted, and benchmarking your code's performance.
- You are allowed to discuss all questions with anyone you like; however: (i) your submission must list anyone you discussed problems with and (ii) you must write up your submission independently.

1. Install METIS 5.0.2, and the corresponding Matlab mex interface

2. Implement various graph partitioning algorithms (60 Points)

I summarize the various benchmark results in table 1. Please note that this table can be generated at will with the script `ex2_bisection_table.m`.

3. Visualize the Fiedler eigenvector (10 Points)

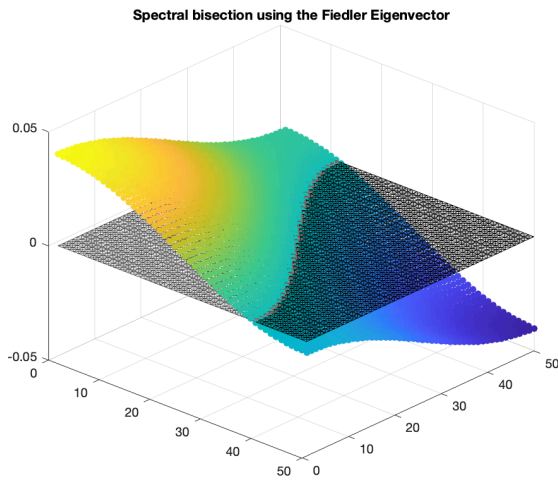
In figure 1 there are graph outputs respectively from *Grid9*, *Small*, and *Eppstein*.

4. Recursively bisecting meshes (20 Points)

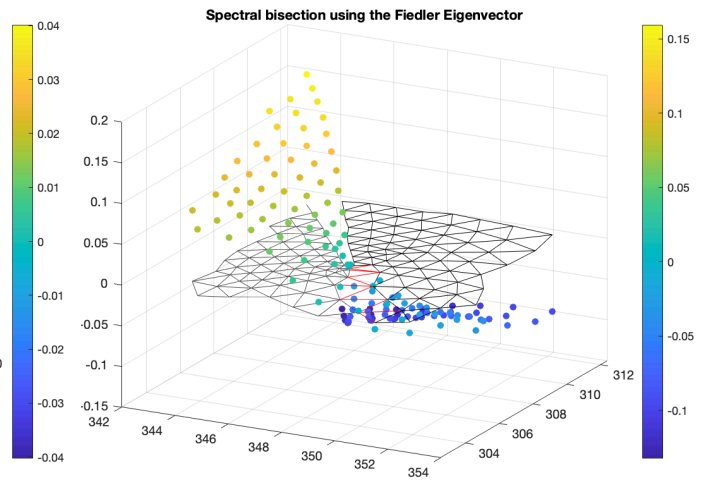
I summarize my results in table 2. Additionally, the graph plots for a recursive partition in 16 parts of *Crack* are available in figure 2.

5. Compare recursive bisection to direct k -way partitioning (10 Points)

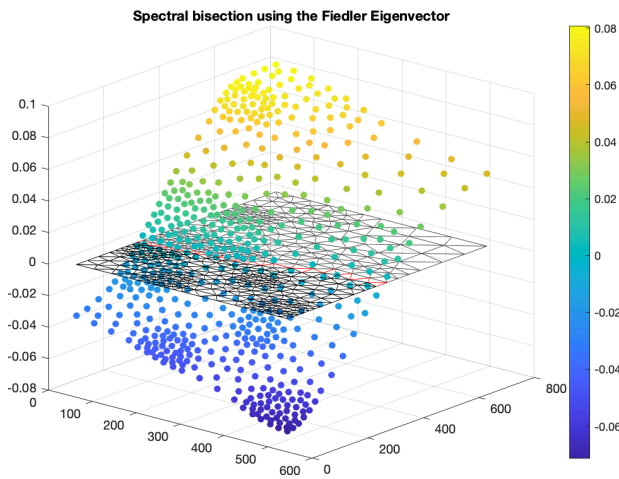
Summarize your results in table 3.



(a) Plot for *Grid9*



(b) Plot for *Small*



(c) Plot for *Eppstein*

Figure 1: Graph outputs for the 3 adjacency matrices.

Table 1: Bisection results

Mesh	Coordinate	Metis 5.0.2	Spectral	Inertial
grid5rect(10,100)	10	10	10	10
grid5rect(100,10)	10	10	10	10
grid5recRotate(100,10,-45)	18	10	10	10
gridt(40)	58	58	58	58
grid9(30)	88	92	104	88
Smallmesh	25	13	12	30
Tapir	55	34	18	49
Eppstein	42	48	45	45

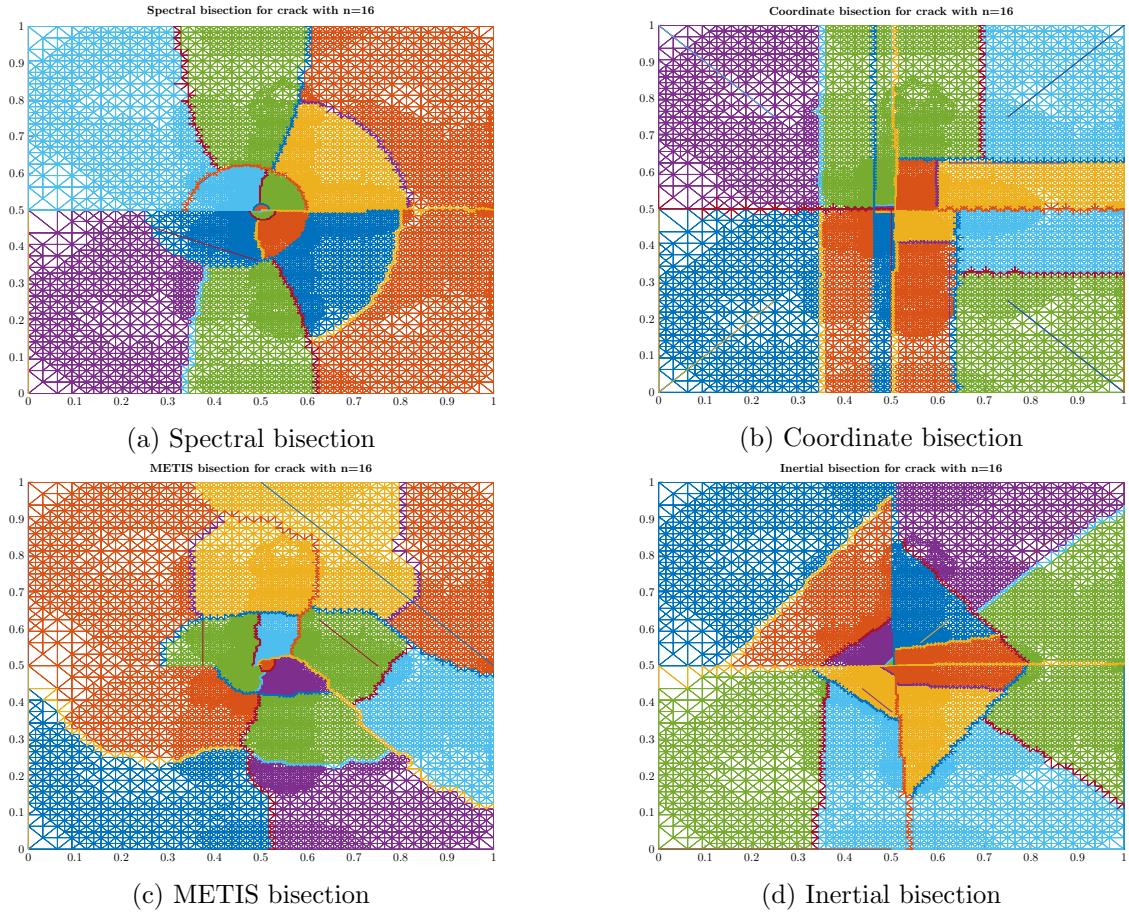


Figure 2: Graph outputs for *Crack* graph with $n = 16$

Table 2: Edge-cut results for recursive bi-partitioning (data for $n = 8$ on the left and $n = 16$ on the right).

Case	Spectral	Metis 5.0.2	Coordinate	Inertial
airfoil1	327 578	320 563	516 819	577 897
3elt	372 671	395 651	733 1168	880 1342
barth4	505 758	405 689	875 1306	891 1350
mesh3e1	72 111	75 117	75 122	67 102
crack	8041303	784 1290	1343 1860	1061 1618

Table 3: Comparing the number of cut edges for recursive bisection and direct multiway partitioning in Metis 5.0.2.

Partitions	crack	airfoil1
16		
32		