Lab 02 - Sparsity Patterns (step-2)

Numerical Solution of PDEs Using the Finite Element Method

MHPC P2.13_seed

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1. See documentation at https://www.dealii.org/8.5.0/doxygen/deal.II/step_2.html
2. Copy and run step-2. Look at the sparsity patterns in firefox.
3. How does the pattern change if you increase the polynomial degree from 1 to 2 or to 3?
4. How does the pattern change if you use a globally refined (say 3 times) unit square?
5. Are these patterns symmetric? Why/why not?
6. How many entries per row in the sparsity pattern do you expect for a Q1 element (assuming four cells are around each vertex)? Check that this is true for the mesh in b) (look for `row_length(i)` and output them for each row). Can you construct a 2d mesh (without hanging nodes) that has a row with more entries?
7. How many entries per row in the sparsity pattern are there for Q2 and Q3 elements, again assuming four cells around each vertex?
8. Print all entries for row 42 for the original renumbered sparsity pattern.
9. Bonus: Compute and output statistics like the number of unknowns, bandwidth of the sparsity pattern, average number of entries per row, and fill ratio.