天元段短课程——有限元编程基础

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作业四：

1. What are the information matrices P, T, and $boundaryedges$ for a triangular mesh of the domain $[0,1]\times[0,1]$ with mesh size $[h_1, h_2]=\left[\frac{1}{4},\frac{1}{4}\right]$?
2. Write a subroutine in .m file to form the matrices P and T for the triangular mesh of the domain $[left, right]\times[bottom, top]$ with mesh size $[h_1, h_2]$.
3. Write a subroutine in .m file to form the matrix $boundaryedges$ for the triangular mesh of the domain $[left, right]\times[bottom, top]$ with mesh size $[h_1, h_2]$.
4. Write a subroutine in .m file to output the results of the subroutines of problems 2 and 3 for $[h_1, h_2]=\left[\frac{1}{4},\frac{1}{4}\right]$ and $[left, right]\times[bottom, top]=[0,1]\times[0,1]$. Then compare the results with your solutions of problem 1.
5. What are the information matrices P_b, T_b, and $boundarynodes$ for the 2D linear finite elements on the domain $[0,1]\times[0,1]$ with mesh size $[h_1, h_2]=\left[\frac{1}{4},\frac{1}{4}\right]$?
6. Write a subroutine to form the matrix $boundarynodes$ for the 2D linear finite elements on the domain $[left, right]\times[bottom, top]$ with mesh size $[h_1, h_2]$. (Note that the matrices P_b and T_b for the 2D linear finite elements are the same as the matrices P and T for the triangular mesh. So the corresponding code is the same as that of problem 2.)
7. What are the information matrices P_b, T_b, and $boundarynodes$ for the 2D quadratic finite elements on the domain $[0,1]\times[0,1]$ with mesh size $[h_1, h_2]=\left[\frac{1}{4},\frac{1}{4}\right]$?
8. Upgrade the subroutine of problem 2 to form the matrices P_b and T_b for the 2D linear/quadratic finite elements on the domain $[left, right]\times[bottom, top]$ with mesh size $[h_1, h_2]$.
9. Upgrade the subroutine of problem 6 to form the matrix $boundarynodes$ for the 2D linear/quadratic finite elements on the domain $[left, right]\times[bottom, top]$ with mesh size $[h_1, h_2]$.
10. Write a subroutine in .m file to output the results of the subroutines of problems 8 and 9 for $[h_1, h_2]=\left[\frac{1}{4},\frac{1}{4}\right]$ and $[left, right]\times[bottom, top]=[0,1]\times[0,1]$. Then compare the results with your solutions of problems 5 and 7.
11. Write subroutines in .m file for the 2D linear and quadratic local basis functions.

问题 3, 8, 9, and 11 的程序将会被用于第三章求解二维方程的程序包！