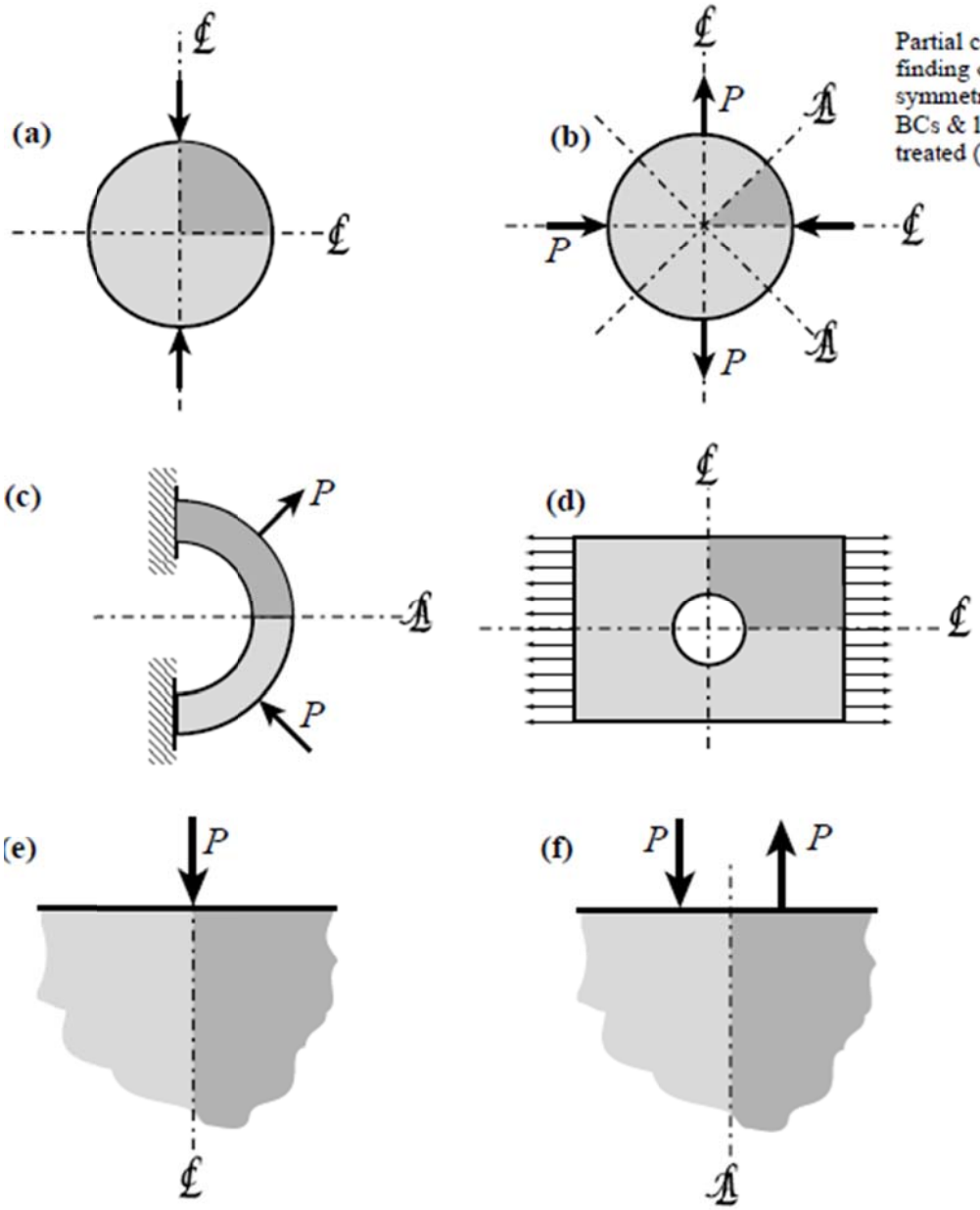
EXERCISE 7.7 Symmetry and antisymmetry lines are identified on Figure E7.11. Problem domains may be reduced to the darker regions. Appropriate supports to realize these symmetry and antisymmetry conditions as well as actual supports (if given) are depicted in Figure E7.11.



Partial credit for finding only the two symmetry lines if BCs & loads are correctly treated (see next figure)

FIGURE E7.11. Symmetry and antisymmetry lines in problems of Exercise 7.4.

EXERCISE 8.1 Here are the results of running the *Mathematica* program under version 4.2:

$$\text{Stiffness } K=\begin{pmatrix} 100 & -100 & 0 & 0 & 0 & 0 & 0 \\ -100 & 200 & -100 & 0 & 0 & 0 & 0 \\ 0 & -100 & 200 & -100 & 0 & 0 & 0 \\ 0 & 0 & -100 & 200 & -100 & 0 & 0 \\ 0 & 0 & 0 & -100 & 200 & -100 & 0 \\ 0 & 0 & 0 & 0 & -100 & 200 & -100 \\ 0 & 0 & 0 & 0 & 0 & -100 & 100 \end{pmatrix}$$

Applied forces={1, 2, 3, 4, 5, 6, 7}

$$\text{Transformation matrix } T=\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\text{Constraint gap vector } g=\left\{0, 0, 0, 0, 0, -\frac{1}{5}, 0\right\}$$

$$\text{Modified Stiffness upon fixing node 1:}\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 400 & -100 & 0 & -100 & -100 \\ 0 & -100 & 200 & -100 & 0 & 0 \\ 0 & 0 & -100 & 200 & -100 & 0 \\ 0 & -100 & 0 & -100 & 200 & 0 \\ 0 & -100 & 0 & 0 & 0 & 100 \end{pmatrix}$$

Modified RHS upon fixing node 1:{0, 48, 3, 4, -15, -13}

$$\text{Computed umod (lacks slave u6)}=\left\{0, \frac{27}{100}, \frac{11}{40}, \frac{1}{4}, \frac{37}{200}, \frac{7}{50}\right\}$$

$$\text{Complete solution } u=\left\{0, \frac{27}{100}, \frac{11}{40}, \frac{1}{4}, \frac{37}{200}, \frac{7}{100}, \frac{7}{50}\right\}$$

Numerical u={0., 0.27, 0.275, 0.25, 0.185, 0.07, 0.14}

$$\text{Recovered forces K.u with reactions}=\left\{-27, \frac{53}{2}, 3, 4, 5, -\frac{37}{2}, 7\right\}$$

Numerical K.u={-27., 26.5, 3., 4., 5., -18.5, 7.}

EXERCISE 9.2 The results of running the given *Mathematica* script for the Lagrangian Multiplier method are shown in Figure E9.4.

$$\text{Kmod} = \begin{Bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 200 & -100 & 0 & 0 & 0 & 0 & 1 \\ 0 & -100 & 200 & -100 & 0 & 0 & 0 & 0 \\ 0 & 0 & -100 & 200 & -100 & 0 & 0 & 0 \\ 0 & 0 & 0 & -100 & 200 & -100 & 0 & 0 \\ 0 & 0 & 0 & 0 & -100 & 200 & -100 & -1 \\ 0 & 0 & 0 & 0 & 0 & -100 & 100 & 0 \\ 0 & 1 & 0 & 0 & 0 & -1 & 0 & 0 \end{Bmatrix}$$

fmod = $\{ 0,\ 2, 3, 4, 5, 6, 7, \frac{1}{5} \}$

Solution u = { 0., 0.27, 0.275, 0.25, 0.185, 0.07, 0.14 }, lambda = −24.5

Recovered node forces = { −27., 26.5, 3., 4., 5., −18.5, 7.}