

**ARCHITECTURAL STRUCTURES I:  
STATICS AND STRENGTH OF MATERIALS**

**ENDS 231**

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**SPRING 2007**

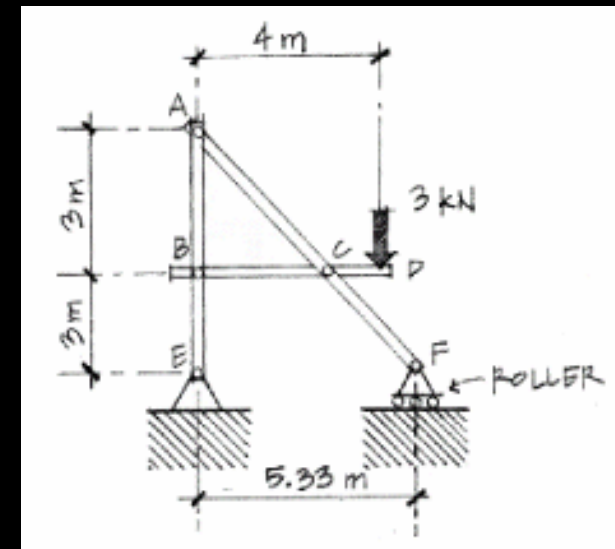
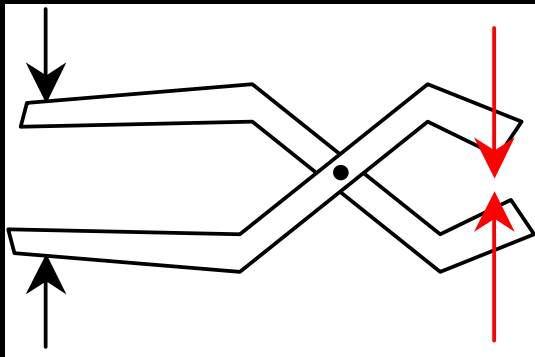
**lecture  
nine**



***pinned frames,  
hinged arches***

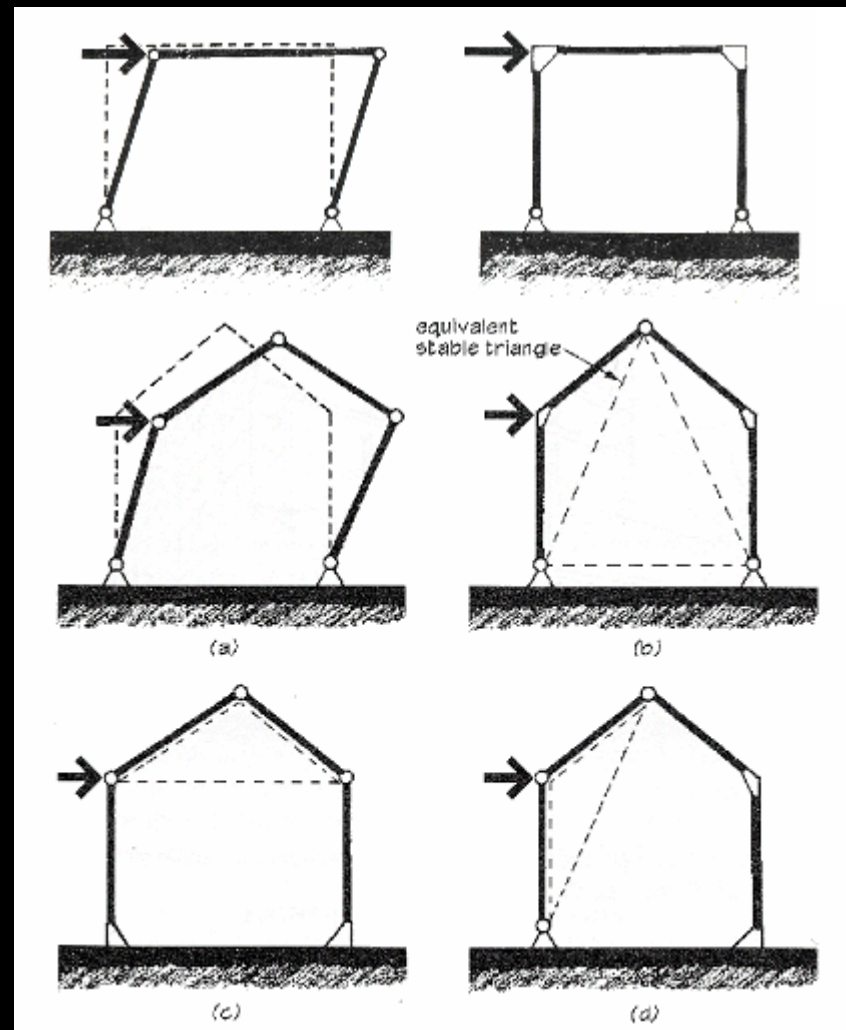
# Pinned Frames

- structures with at least one 3 force body
- connected with pins
- reactions are equal and opposite
  - non-rigid
  - rigid



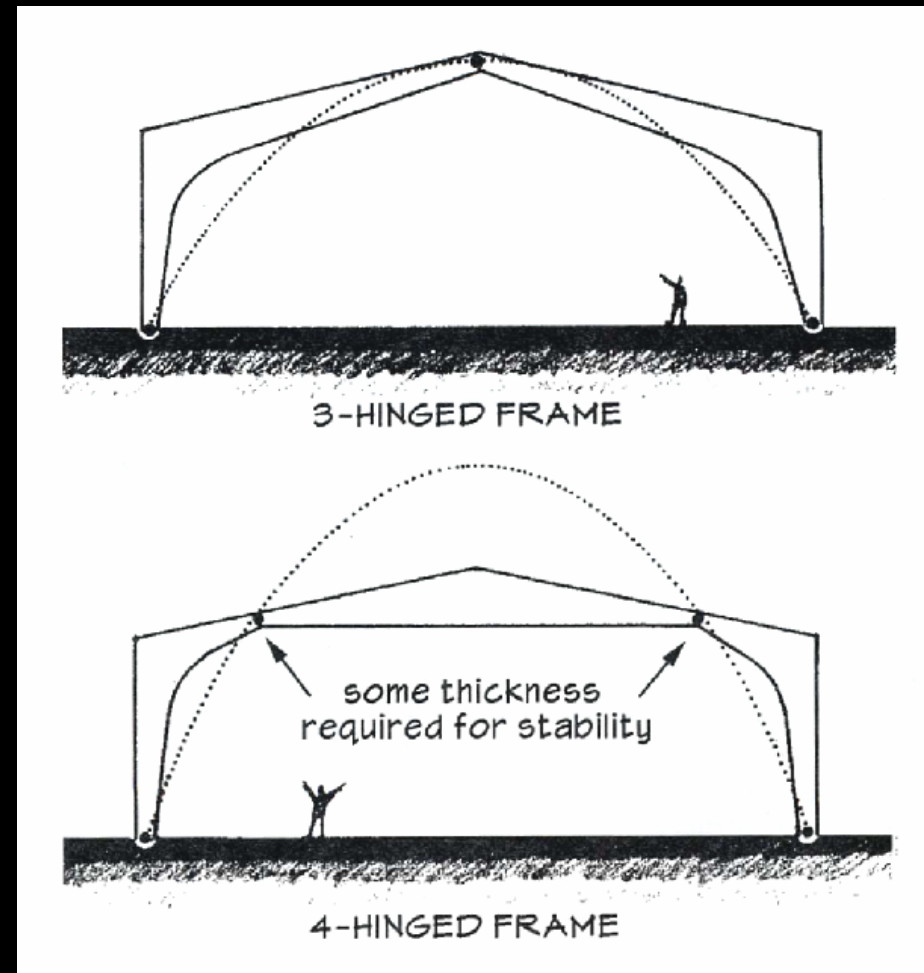
# Rigid Frames

- rigid frames have no pins
- frame is all one body
- typically statically indeterminate
- types
  - portal
  - gable



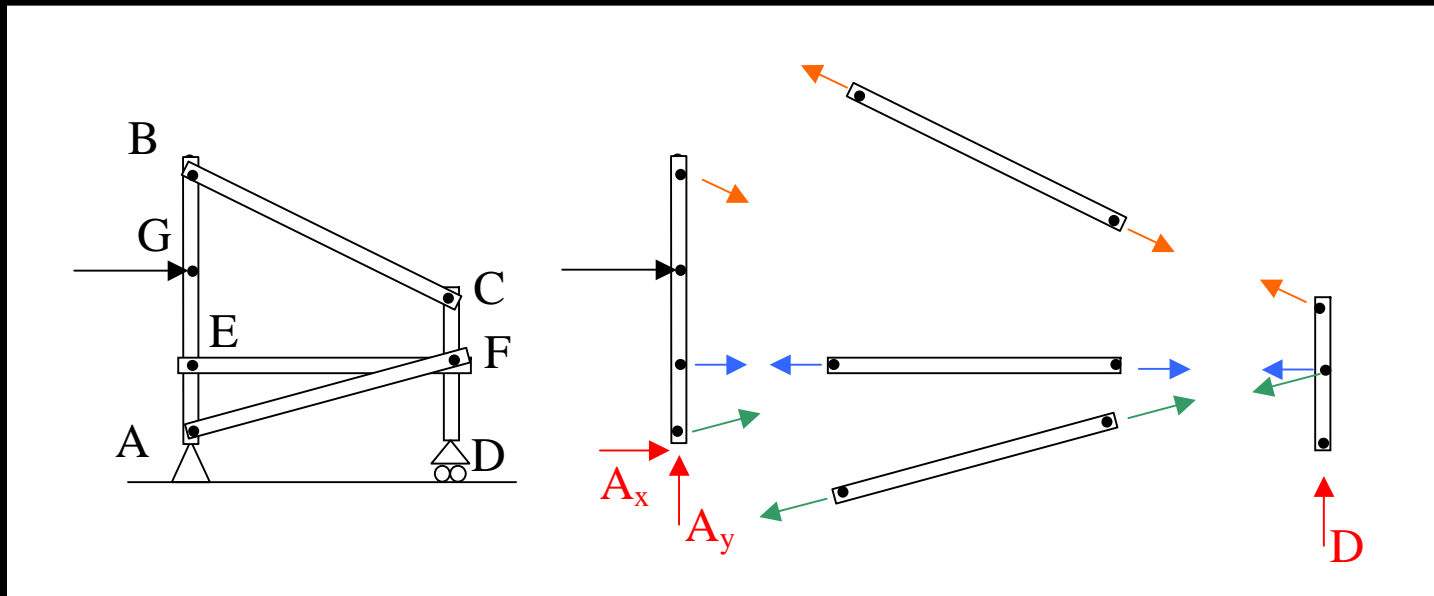
# Rigid Frames with PINS

- *frame pieces with connecting pins*
- *not necessarily symmetrical*



# Internal Pin Connections

- *statically determinant*
  - 3 equations per body
  - 2 reactions per pin + support forces





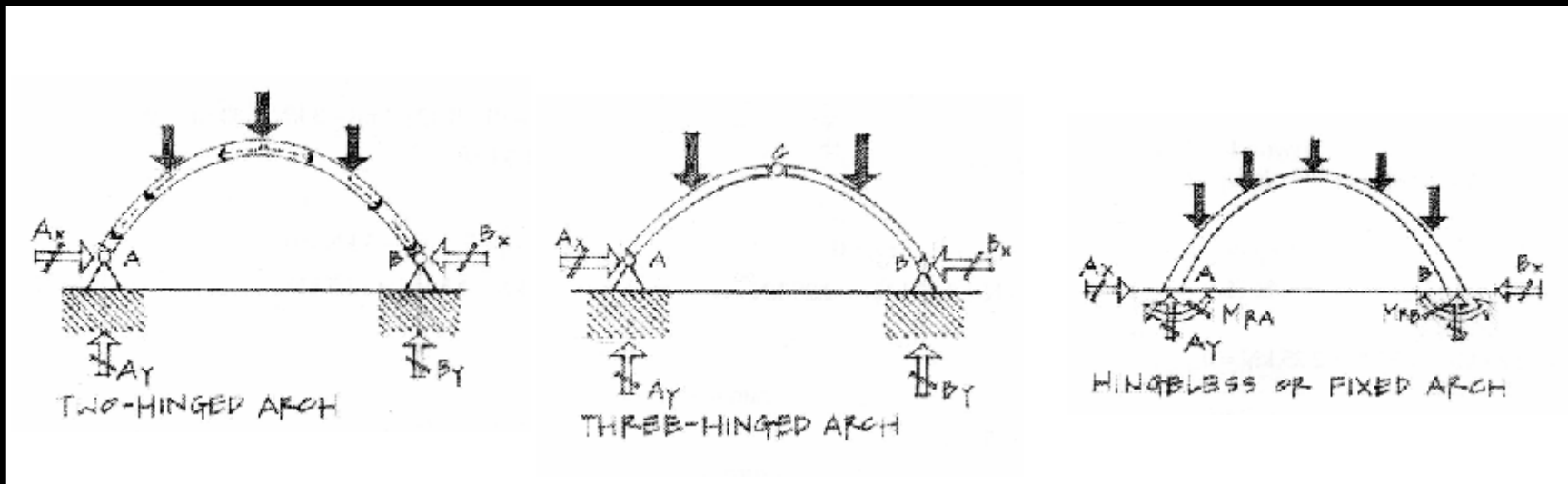
# Arches

- *ancient*
- *traditional shape to span long distances*



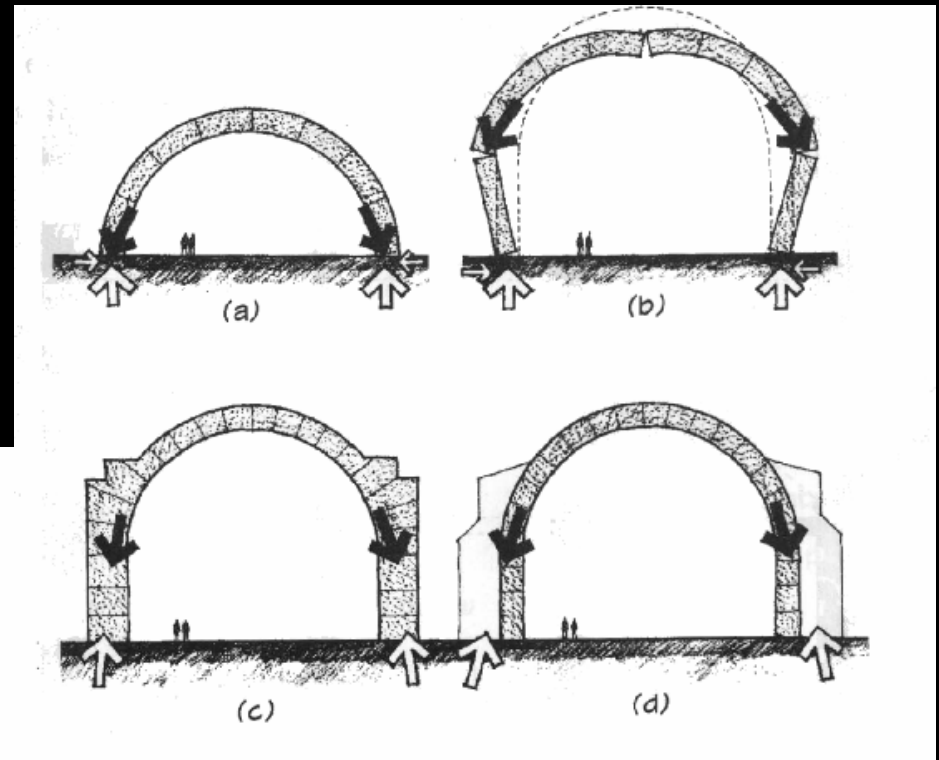
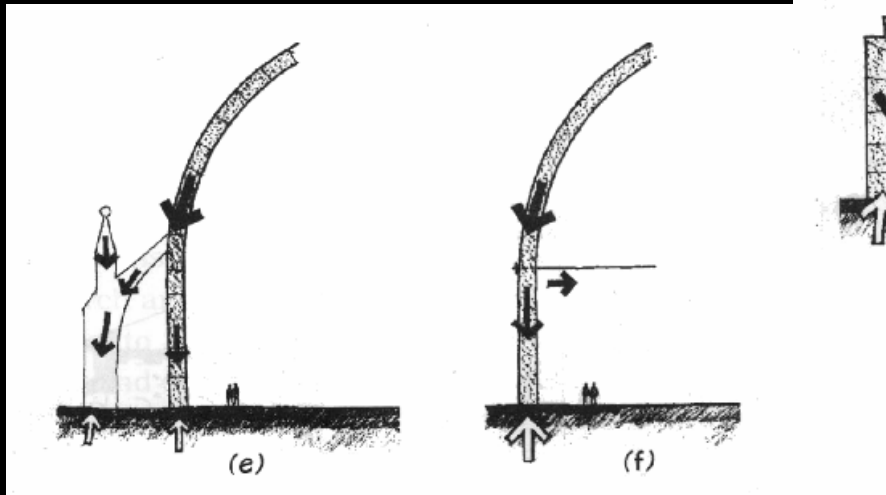
# Arches

- *primarily sees compression*
- *a brick “likes an arch”*



# Arches

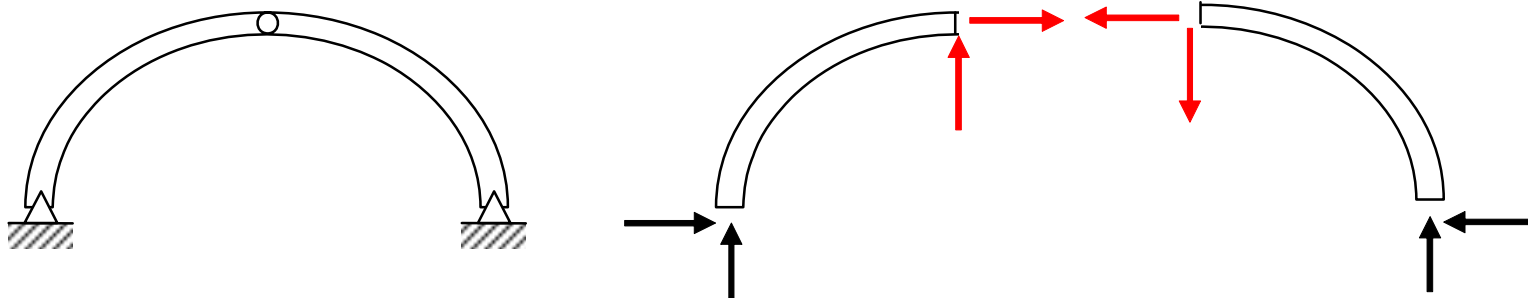
- *behavior*
  - *thrust related to height to width*





# Three-Hinged Arch

- *statically determinant*
  - 2 bodies, 6 equilibrium equations
  - 4 support, 2 pin reactions (=6)



# *Procedure*

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- *solve for all support forces you can*
- *draw a FBD of each member*
  - *pins are integral with member*
  - *pins with loads should belong to 3+ force bodies*
  - *pin forces are equal and opposite on connecting bodies*
  - *identify 2 force bodies vs. 3+ force bodies*
  - *use all equilibrium equations*