ARCHITECTURAL STRUCTURES I:
STATICS AND STRENGTH OF MATERIALS

ENDS 231

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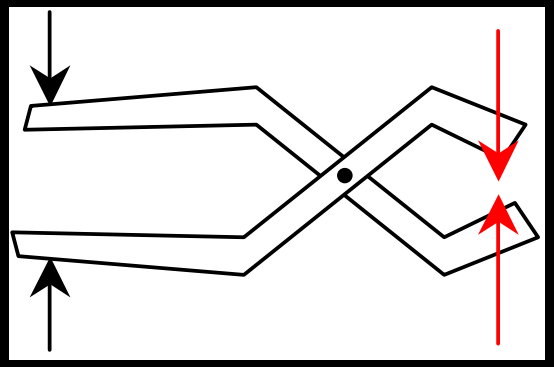
FALL 2007

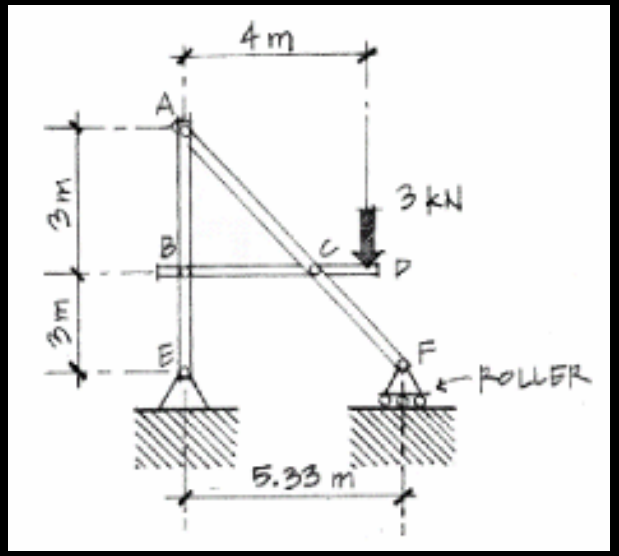
lecture
nine

pinned frames, hinged arches

Pinned Frames

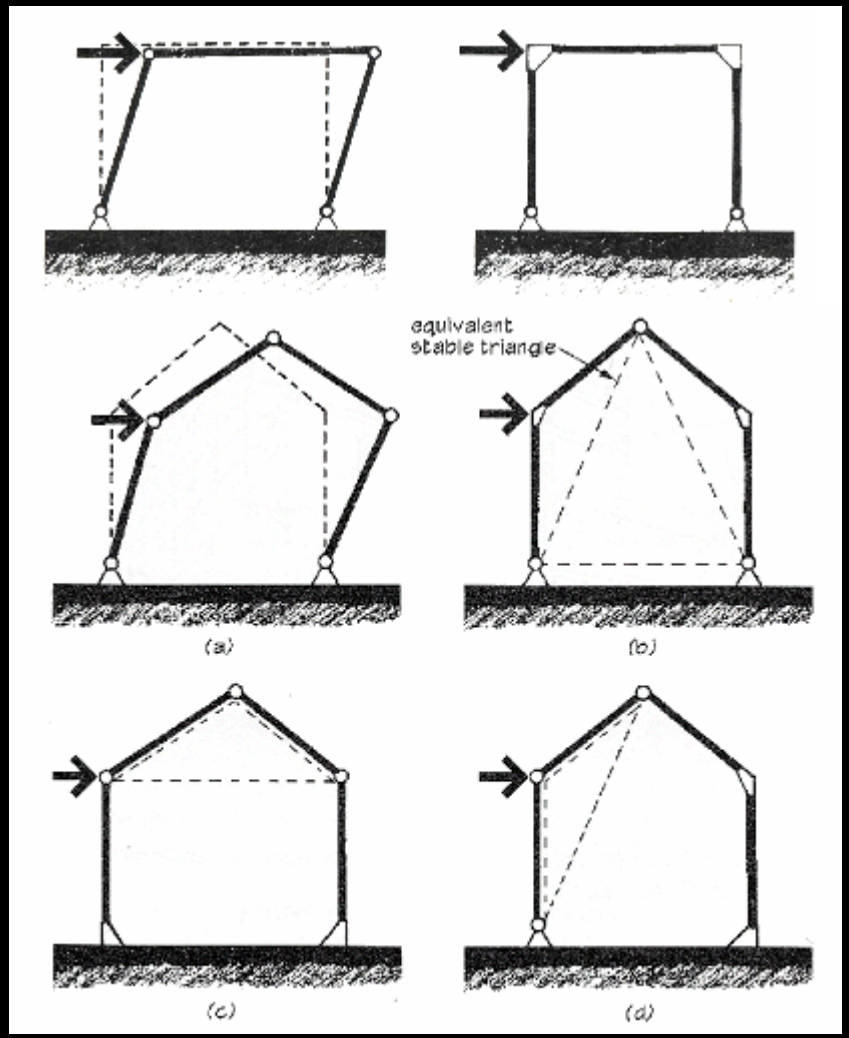
- *structures with at least one 3 force body*
- *connected with pins*
- *reactions are equal and opposite*
  - *non-rigid*
  - *rigid*





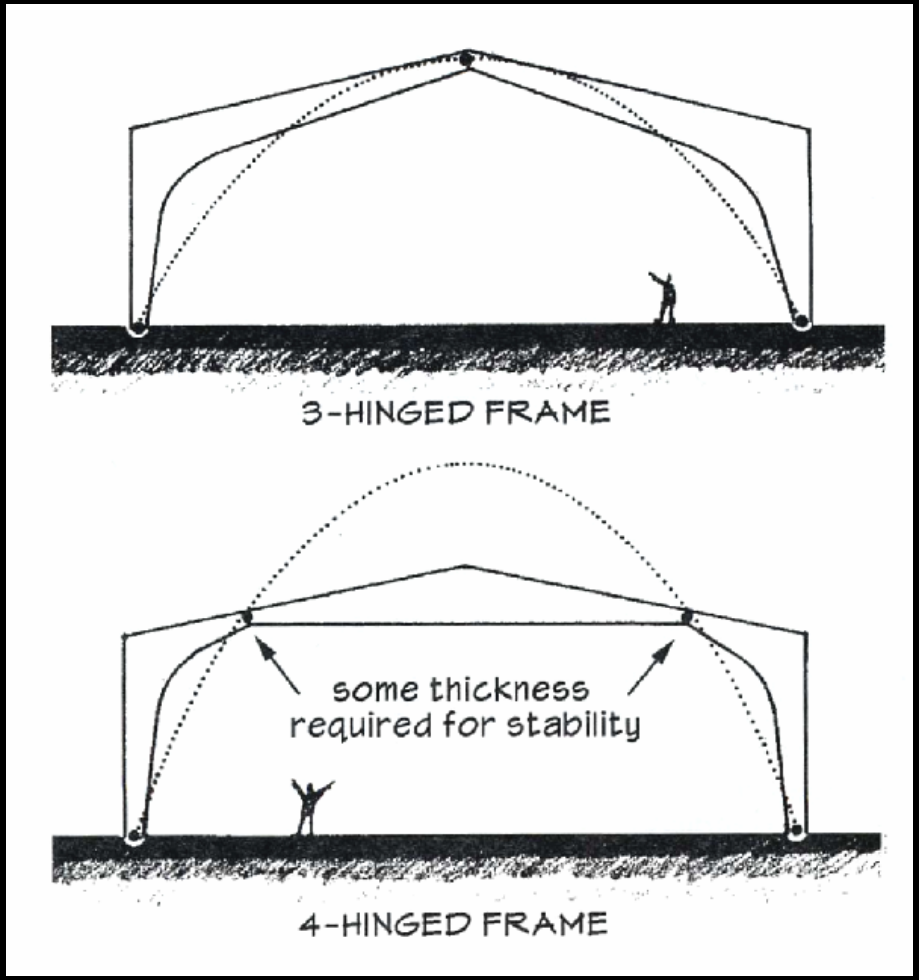
Rigid Frames

- *<u>rigid</u> frames have no pins*
- *frame is all one body*
- *typically statically indeterminate*
- *types*
  - *portal*
  - *gable*



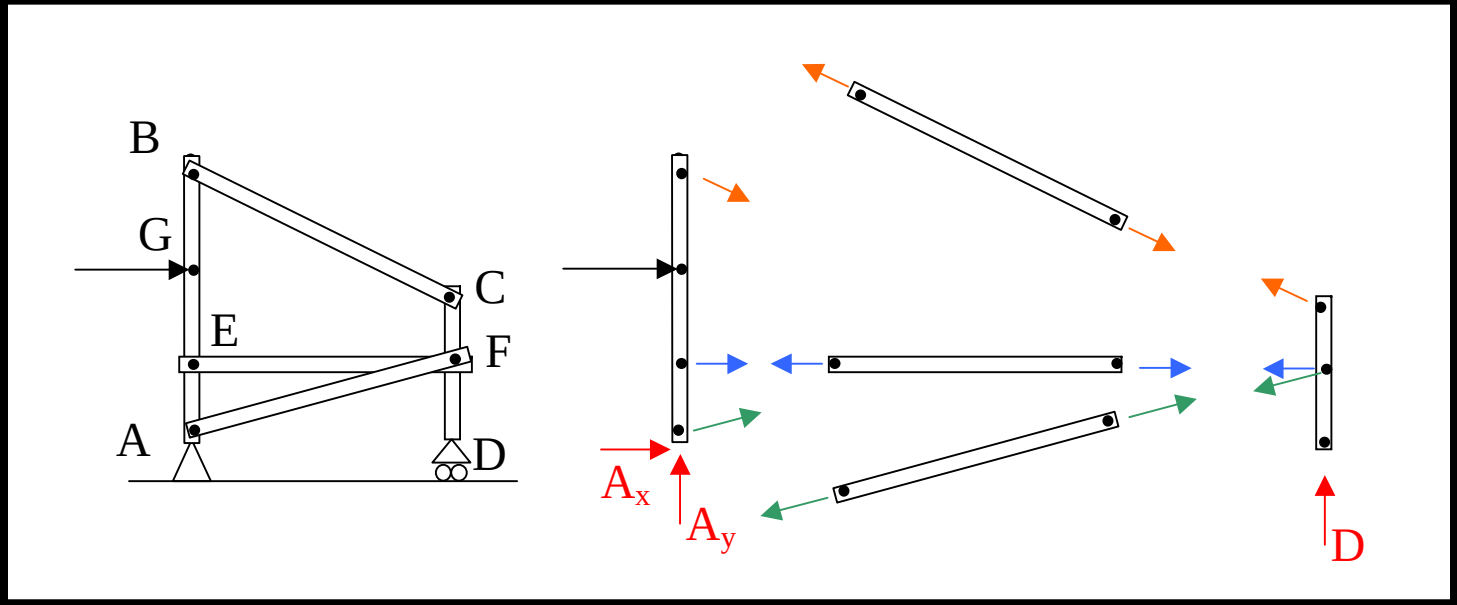
Rigid Frames with PINS

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



Internal Pin Connections

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

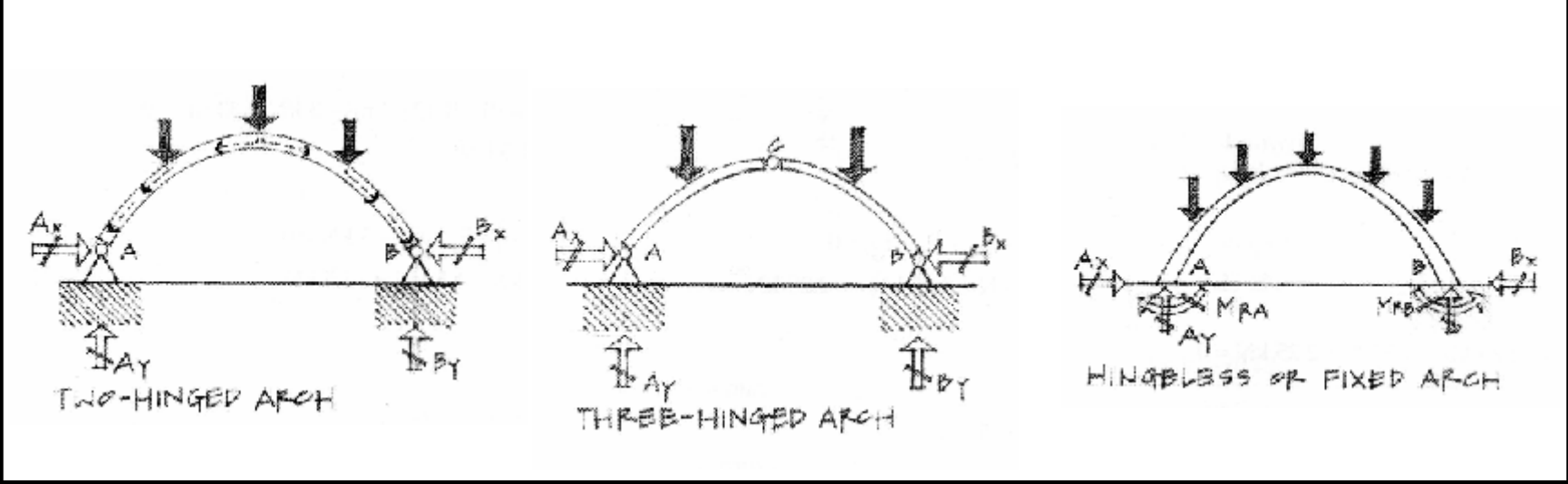


Arches

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

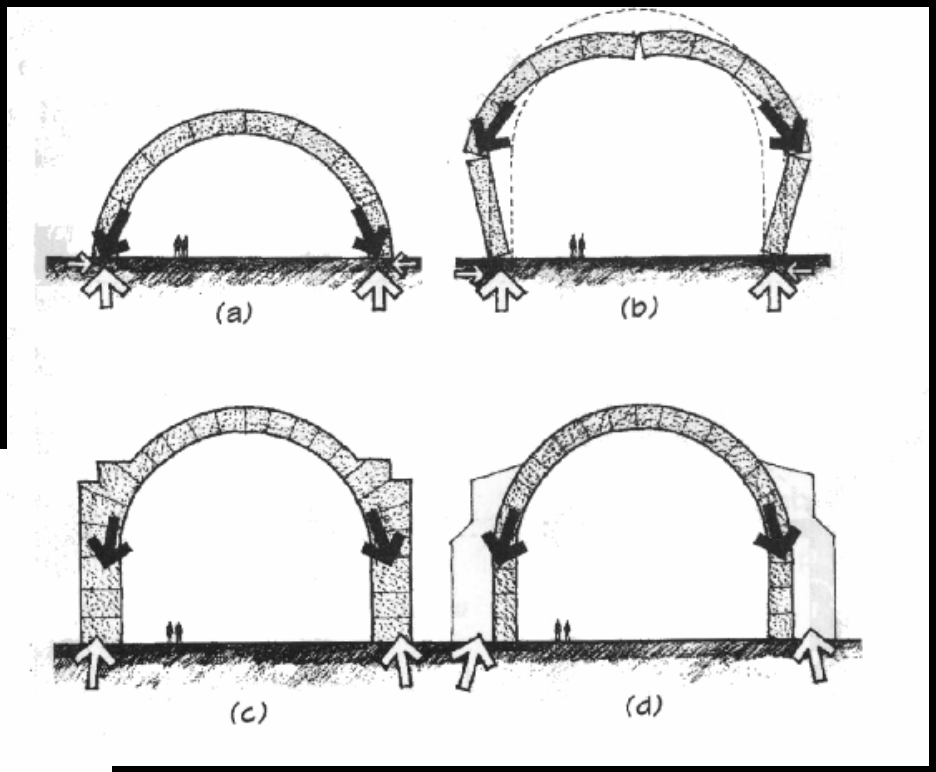
Arches

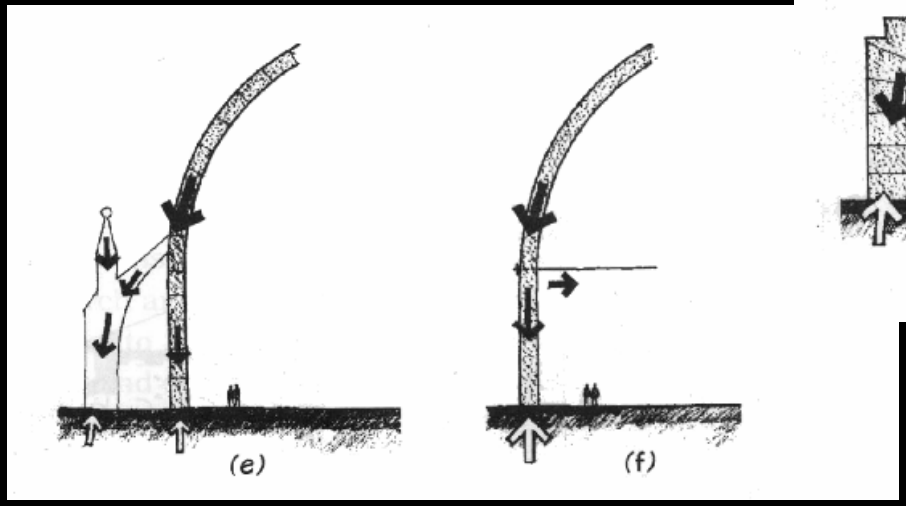
- *primarily sees compression*
- *a brick "likes an arch"*



Arches

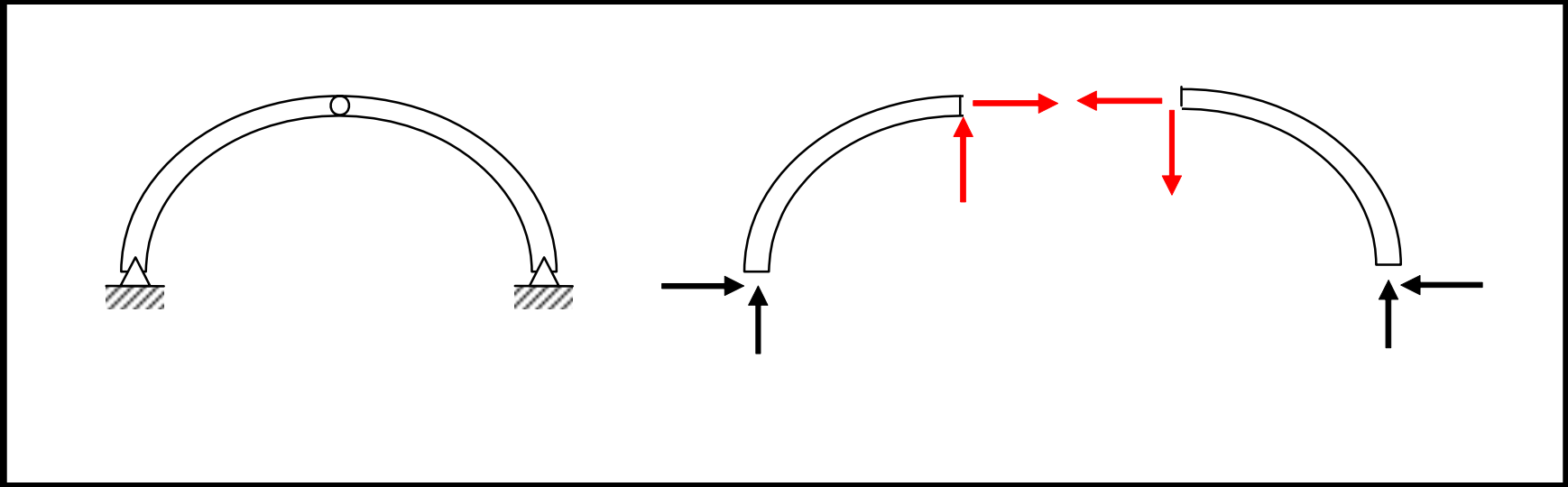
- *behavior*
  - *– thrust related to height to width*





Three-Hinged Arch

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



Procedure

- *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*