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PID-A53319594

Case 1: Mitchell Truss

Question:

A) Is this structure potentially inconsistent? What does that mean?
B) is this structure undetermined? What does that mean? If it is underdetermined, is it pretensionable, or only tensionable under load? Discuss.
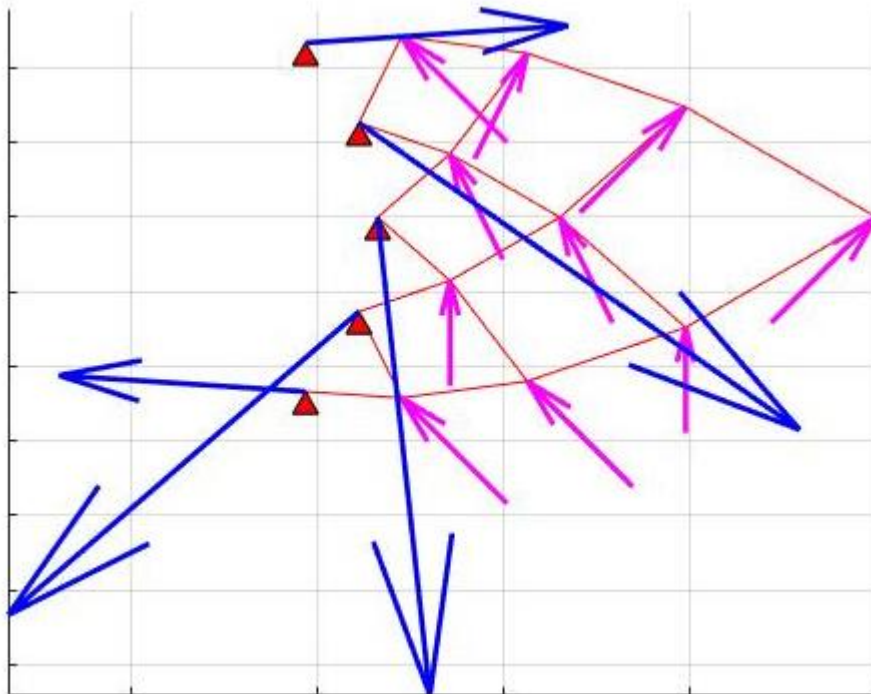Also include any other salient points regarding these designs. You are encouraged to explore well beyond the specific questions asked; extra credit will be granted as appropriate.

Answer:

A) The structure is not potentially inconsistent. This means that A_{se} has linearly independent rows.
B) The structure is not undetermined. In this case, it means that it has equal number of independent equations and unknowns.

The structure is neither undetermined nor potentially inconsistent and the solution obtained is unique. It meets the condition of static determinance. However, it is to be noted that some bars are not under compression and some strings are not under tension.

Case 2: Nonminimal Prism

Question:

A) Is this structure potentially inconsistent? What does that mean?
B) is this structure undetermined? What does that mean? If it is underdetermined, is it pretensionable, or only tensionable under load? Discuss.
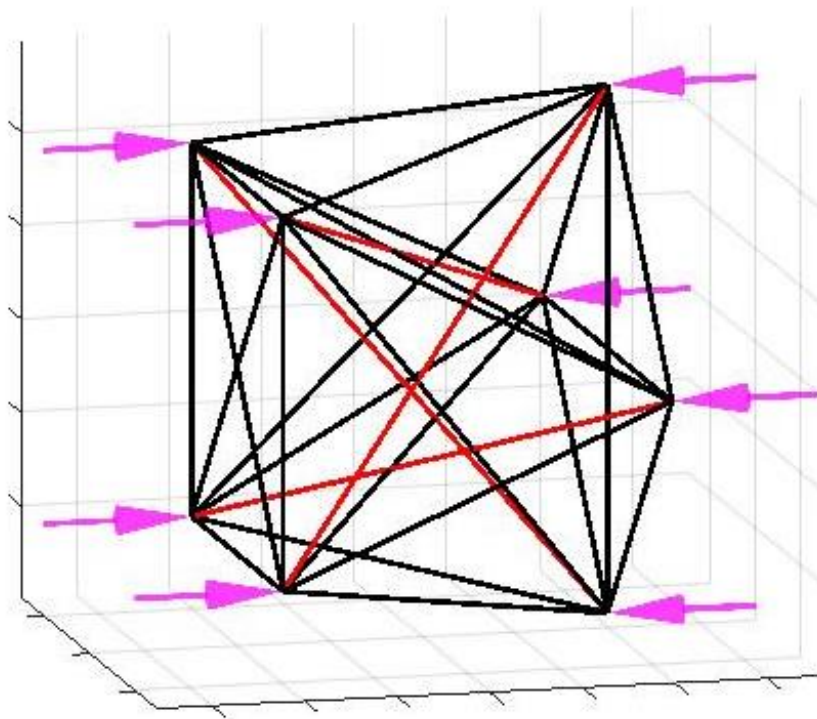Also include any other salient points regarding these designs. You are encouraged to explore well beyond the specific questions asked; extra credit will be granted as appropriate.

Answer:

A) The structure is potentially inconsistent, implying the presence of soft modes or instability. This means that A_{se} has some rows which are linearly dependent on other rows.

B) The structure is undetermined with 10 Degree of Freedom. Thus, there are fewer independent equations than there are unknowns. It is not pretensionable, which means all strings are not under tension for zero external loading. It is only tensionable under load, which means that there is a range of realizable force density distributions in the members, with all strings in tension, for some nonzero nominal external load.

No bars are under tension in this structure. It is to be noted that some strings are not under tension in this structure. Also if there is any force applied in the X and Z direction the structure deforms. Also, if all the forces applied to the Y direction are not equal in magnitude and don't cancel each other out to give the net force on the structure in the Y direction as 0, the structure deforms too.

Case 3: T-Bar self-similar n = 4, constant α (Fig. 3.9 of Skelton & de Oliviera 2009)

Question:

A) Is this structure potentially inconsistent? What does that mean?
B) is this structure undetermined? What does that mean? If it is underdetermined, is it pretensionable, or only tensionable under load? Discuss.
Also include any other salient points regarding these designs. You are encouraged to explore well beyond the specific questions asked; extra credit will be granted as appropriate.

Answer:

A) The structure is potentially inconsistent, implying the presence of soft modes or instability. This means that A_{se} has some rows which are linearly dependent on other rows.
B) The structure is undetermined with 7 Degree of Freedom. Thus, there are fewer independent equations than there are unknowns. It is pretensionable, which means all strings are under tension for zero external loading.

No bars are under tension in this structure. All the strings are under tension in this structure. Note that no external force in applied in this structure.