7.2 Plane Trusses

Examples for Method of Joints
7.2 Plane Trusses
Examples for Method of Joints

Vehicle weight = mg = 9810 N

A: AB, AE
B: BC, BE
C: CD, CF
D: Dx
F: Fx, Fy

Reactions must be obtained first
7.2 Plane Trusses
Examples for Zero-Force Members
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Examples for Zero-Force Members
7.2 Plane Trusses
Method of Sections

Method of joints is more convenient when the truss is relatively simple and forces in all members are needed.

Method of sections is more convenient when the truss is relatively complex and forces in only a few members are needed.
7.2 Plane Trusses
Method of Sections

1. If necessary, draw a free-body diagram of the entire truss and determine the reactions (if \( r = 3 \)).

2. Divide the truss into two parts by passing an imaginary section through member(s) whose member forces are needed. Draw a free-body diagram for each part.

3. Set up equilibrium equations for either free-body diagram and solve them to obtain the unknown member forces.

\[
\begin{align*}
\sum F_x &= 0 \\
\sum F_y &= 0 \\
\sum M &= 0 \\
\end{align*}
\]
7.2 Plane Trusses
Method of Sections

\[ \sum M_G = 0 \Rightarrow T_{CD} \]
\[ \sum M_D = 0 \Rightarrow T_{FG} \]
\[ \sum M_I = 0 \Rightarrow T_{DG} \]

\[ \sum F_x = 0 \] \Rightarrow \{T_{CD}, T_{DG}, T_{FG}\}
\[ \sum F_y = 0 \] \Rightarrow \{T_{CD}, T_{DG}, T_{FG}\}
\[ \sum M = 0 \]
7.2 Plane Trusses
Method of Sections
K-Truss

\[ \sum M_D = 0 \Rightarrow T_{FG} \]
\[ \sum M_F = 0 \Rightarrow T_{CD} \]
7.2 Plane Trusses
Method of Sections

Reactions at A and B
Section 1: AC, BE
Section 2: CF, EH
Section 3: IF, HK
Section 4: LI, KN

Joint V: VL, VT
Joint R: RO, RT
Joint T: TL, TO
Joint O: OL, OP
Joint P: PL, PN
Joint N: NM
Joint I: IJ
Joint J: JF, JH
Joint H: HG
Joint C: CD
Joint A: AB

Joint W: WN, WU
Joint S: SQ, SU
Joint U: UN, UQ
Joint Q: QN, QP
Joint L: LM
Joint M: MI, MK
Joint K: KJ
Joint F: FG
Joint G: GC, GE
Joint D: DA, DB
Joint B: Check
7.3 Space Trusses

\[ \vec{P} = 125 \left( \sin 30^\circ \, \vec{j} - \cos 30^\circ \, \vec{k} \right) \text{lb} \]

\[ m = 3j - 6 \quad \text{or} \quad m = 3j - r \]

\[ \vec{A} = A_x \vec{i} + A_y \vec{j} + A_z \vec{k} \]

\[ \vec{B} = B \vec{z} \vec{k} \]

\[ \vec{C} = C_x \vec{i} + C_y \vec{j} + C_z \vec{k} \]

\[ \vec{F}_{AB} = T_{AB} \frac{3\vec{i} + 2\vec{j}}{\sqrt{3^2 + 2^2}} \]

\[ \vec{F}_{AC} = T_{AC} \frac{3\vec{i} - 2\vec{j}}{\sqrt{3^2 + 2^2}} \]

\[ \vec{F}_{AD} = T_{AD} \frac{-2\vec{i} - 3\vec{k}}{\sqrt{2^2 + 3^2}} \]

\[ \vec{F}_{BC} = T_{BC} \vec{j} \]

\[ \vec{F}_{BD} = T_{BD} \frac{-\vec{i} - 2\vec{j} - 3\vec{k}}{\sqrt{1^2 + 2^2 + 3^2}} \]

\[ \vec{F}_{CD} = T_{CD} \frac{-\vec{i} + 2\vec{j} - 3\vec{k}}{\sqrt{1^2 + 2^2 + 3^2}} \]

\[ \vec{A} + \vec{F}_{AB} + \vec{F}_{AC} + \vec{F}_{AD} = 0 \]

\[ \vec{B} + \vec{F}_{AB} + \vec{F}_{DC} + \vec{F}_{BD} = 0 \]

\[ \vec{C} + \vec{F}_{AC} + \vec{F}_{BC} + \vec{F}_{CD} = 0 \]

\[ \vec{P} + \vec{F}_{AD} + \vec{F}_{BD} + \vec{F}_{CD} = 0 \]
7.2 Plane Trusses
Forces in Straight and Curved Two-Force Members

\[ P = T \quad V = 0 \quad M = 0 \quad P = T \sin \alpha \quad V = T \cos \alpha \quad M = Td = Tr \sin \alpha \]