**Modelling**

In this section of the report, the mathematic model of the Howe truss analysis will be built to support the conceptual understanding of the truss structure and evaluating the internal forces within the truss members. Specifically, the process of determining the critical member in the truss, the calculations of the expected failure load of the truss member and diagrams for horizontal and vertical truss members under tension will be detailed.

* The process of identifying the critical member
* The calculations of the Expected Failure Load
* The plots for horizontal and vertical truss members under tension

**The process of identifying the critical member**

The critical member in a truss is the one most likely to fail under certain mechanical condition. To identify the position of critical members, the general strategy that has been adopted in the experiment is by analysing the internal force within each truss member. Since the truss is in equilibrium, the internal force can be represented as function in terms of fixed dead load and changing dead load by applying the equations of equilibrium. The first truss member with internal force reaching the expected failure load is the suspected critical member. The complete 5-step process is detailed below:

1. The Free Body Diagram of the Howe truss

Based on the dimension, supports condition and applying external forces of the Howe truss, the FBD with appropriate labelling has been drawn to assist analysis.

1. The identification of zero force members to simplify truss structure

To simplify the analysis, the second step is reducing the truss structure by removing the zero force members. Zero force members present in the manner of two members are connected without external load acts along either member or three members are connected in orthogonal way with no external force. In the specific case of Howe truss with external force exerting on point D and E, no zero force members present.

1. The formation of internal force within each truss member as a function of live load and dead load

By applying the equations of equilibrium at each joint of the truss, internal force functions are obtained to quantify the analysis.

1. The calculation of Expected failure load

The fourth step of the process is to determine the critical condition of failure, which is the expected failure load based on the nominal cross-sectional area of the specimen and the standard Stress-strain curve.

1. The interpretation of the internal forces with the Expected failure load

The terminal internal force within each truss member can be predicted from the functions obtained from step 3. The first truss member with internal force meeting the condition of expected failure load is the suspected critical member.

**The calculations of the Expected Failure Load**

1. The determination of failure point in Stress-Strain curve

Since the weight of live load is constantly increasing until the failure in the experiment, the ultimate tensile strength is adopted as a sensible failure point to be processed.

1. The calculation of the Expected failure load based on nominal dimension
2. Strategy: The presentation of used formulas

(N / mm2)

1. Solution: the process of plugging in values and yielding out answer

σ = 80 (N / mm2)

A = 2 (mm2)

F = σ • A = 160 (N)

**The plots for horizontal and vertical truss members under tension**

Section A: The plots for horizontal truss members under tension

The predicted terminal live load for truss member IH is 282.5 Newtons.Chart, line chart

Description automatically generated

The predicted terminal live load for truss member HG is 122.5 Newtons.Chart, line chart

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The predicted terminal live load for truss member GF is 69.2 Newtons.Chart, line chart

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The predicted terminal live load for truss member FE is 42.5 Newtons.Chart, line chart

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The predicted terminal live laod for truss member DC is 44.2 Newtons.Chart, line chart

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The predicted terminal live load for truss member ED is 44.2 Newtons.Chart, line chart

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The predicted terminal live load for truss member BC is 97.5 Newtons.Chart, line chart

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The predictred live load for truss member BA is 257.5 Newtons.Chart, line chart

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Section B: The plots for vertical truss members under tension

The predicted live load for truss member BJ is 257.5 Newtons.Chart, line chart

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The predicted live load for truss member CK is 257.5 Newtons.Chart, line chart

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The predicted live load for member DL is 257.5 Newtons.Chart, line chart

Description automatically generated

The predicted terminal live load for truss member EM is 160.0 Newtons.Chart, line chart

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The predicted live load for truss member GO is 282.5 NewtonsChart, line chart

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The preidcted terminal live load for truss member HP is 282.5 Newtons.Chart, line chart

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The predicted terminal live load for truss member FN is 282.5 Newtons.Chart, line chart

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**THE TAIL OF THE THIS SECTION. DEPENDING ON THE FOLLOWING PAERT OF THE REPORT!!!**