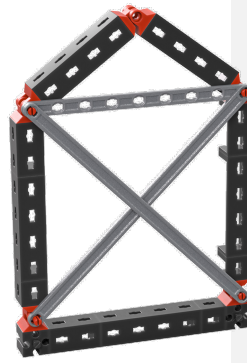## Model 10
Half-timbering

The students receive the building instructions for the construction of the half-timbered house.

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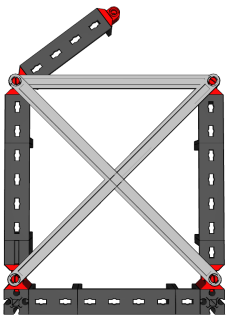
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THEMATIC TASK

Internal static stability

Result of testing: You can remove a single strut and the model will still remain stable. This applies to every "bar" in the rectangle, as well as the diagonals. As soon as one of these bars is removed, the model is statically determined. Only when another rod is removed do parts of the half-timbering become movable. This means that the model is simply statically overdetermined in its original form.

1./2.   Examples of variants that are statically determined:
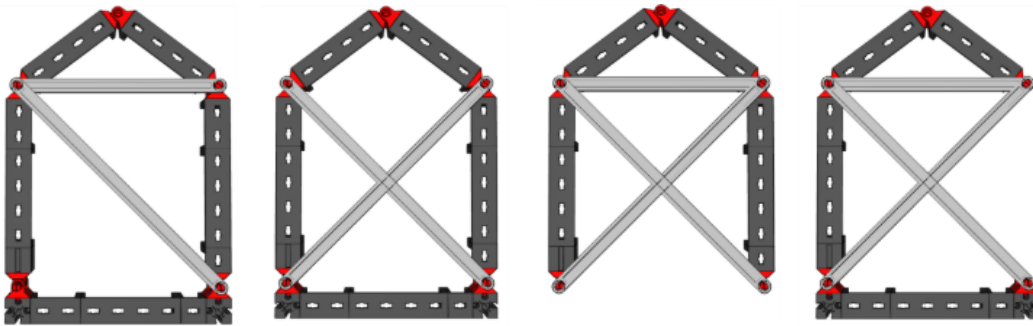
Here is an example where this is not the case:

The top rod is movable and the rectangle is statically overdetermined.

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3. The following applies to determining the static determinacy in planar trusses:

n = number of rods

k = number of nodes

n = 2k – 3 = statically determined

n < 2k – 3 = movable (under-determined)

n > 2k – 3 = statically overdetermined

In our example, therefore, $7 = 2 * 5 - 3$ is correct – the house is statically determined. The original model had n = 8 bars and also 5 nodes. 8 > 7
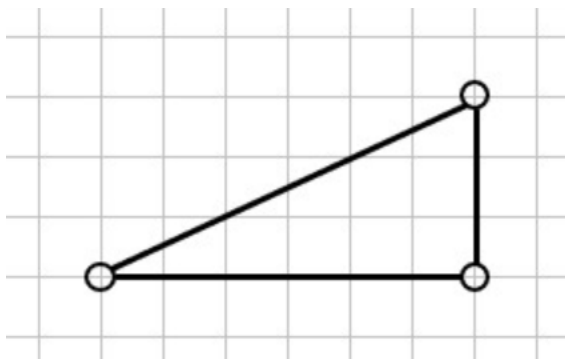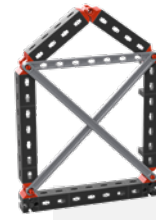
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EXPERIMENTAL TASK

There is a simple "trick" for creating simple statically determined half-timberings: First, take a simple rod that is hinged on the right and left.

This is statically determined: $1 = 2 * 2 – 3$ | correct

If you now extend the beam into a triangle with two additional members, the formula also applies: $3 = 2 * 3 – 3$ | correct

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This way, you can extend your half-timbering by two bars (= 1 triangle) with each step, and the formula will be correct every time. It does not matter how long the bars in the half-timbering are. For an initial assessment of a complicated half-timbering, you can do the opposite: if you keep "removing" two bars from the half-timbering until only one beam remains, you can quickly assess whether this flat half-timbering is statically determined internally. If it is still 3-valued, it is indeed statically determined internally and externally.
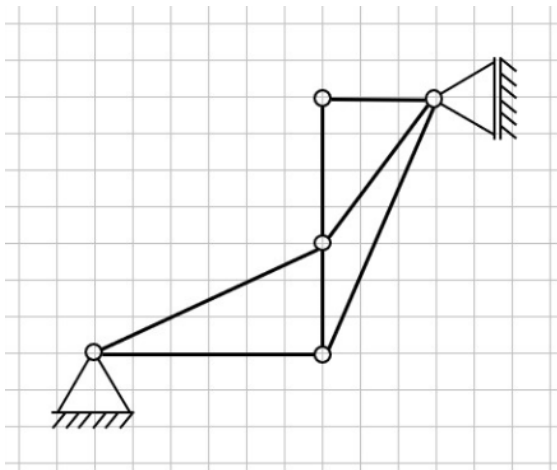
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APPENDICES

Building instructions and templates Models:

Model 10: Building instructions for truss.

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