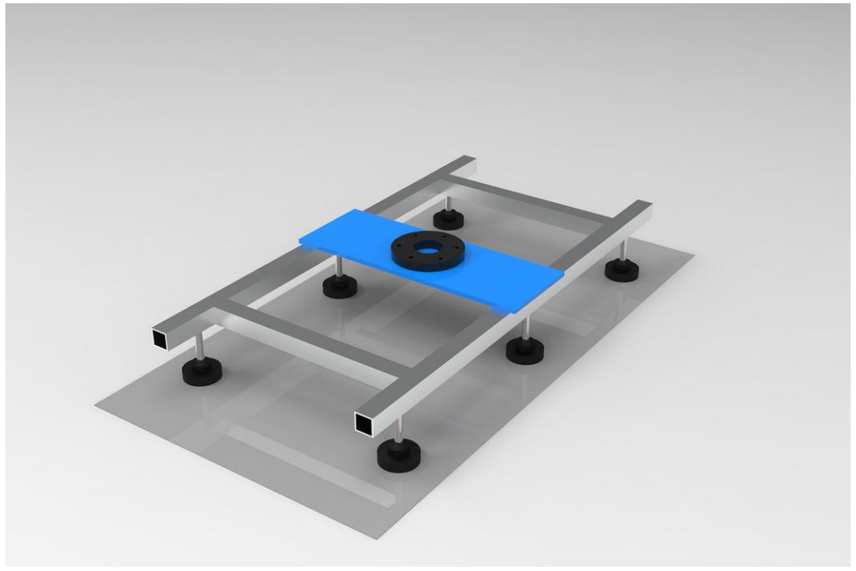
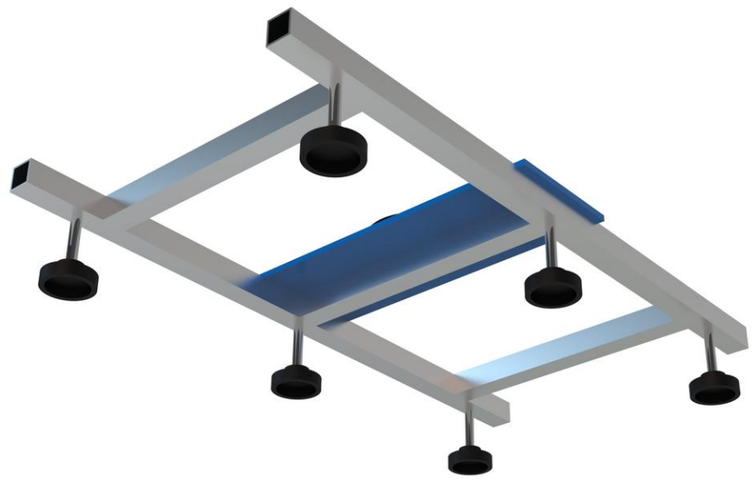
Robot vacuum gripper for sheet panels, 12 kg

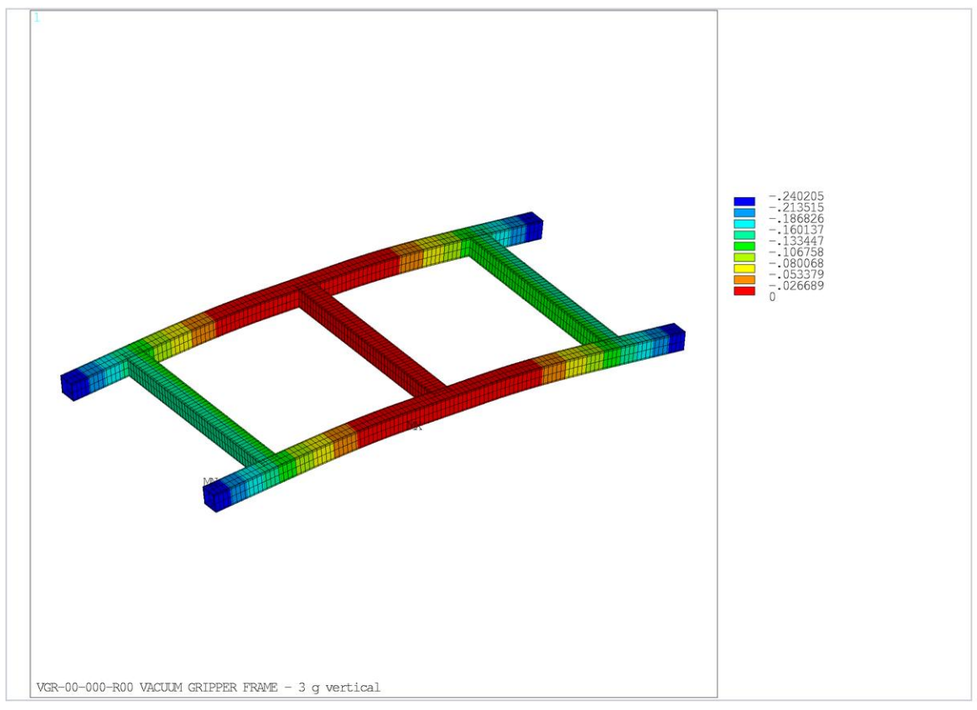
Concept design · parametric 3D CAD · holding force and hand checks in MATLAB · beam FEA and modal





Design data

Payload	sheet panel up to 12 kg
Panel size	up to 1300 x 700 mm
Cups	6 x D80, 60 % vacuum
Holding force	1810 N theoretical
Frame	tube 40 x 40 x 3, EN AW-6063
Frame size	1100 x 540 mm
Robot flange	PCD 125, 6 x D9, pilot D63
Gripper mass	9.4 kg, 0 interferences
Wrist load	21.4 kg, CoG 126 mm below the flange



Results

	FEA	Hand (MATLAB)
Corner cup deflection at 3 g	0.17 mm	0.16 mm
Frame stress at 3 g	5.7 MPa	5.6 MPa
First natural frequency	67 Hz	68 Hz
Safety, 2 g vertical		5.1 (4.3 with 5 cups)
Safety, 1 g horizontal		2.6 (2.1 with 5 cups)
Safety, panel vertical, 0.5 g		2.05 (1.7 with 5 cups)

Method

Holding force from cup area and vacuum level, with friction 0.2 for oiled sheet: it gives the accelerations the robot may use with a safety factor of 2, also with one cup lost. The frame is stiffness-driven: a beam model (376 elements, cups and panel share as point masses, mounting plate rigid) gives deflection at 3 g and the first natural frequencies; the hand cantilever model matches within 5 %.