

Bernhard Sill: *Research on Adaptive and Kinetic Structures*

This research work is exploring kinetic structures, adapting to different climatic conditions or reconfiguring to various functions. These systems express ephemeral qualities, moments of fleeting beauty.

The intent is to cultivate a new vocabulary for kinetic architecture, expanding the established range with adaptive, convertible and kinetic architectural systems.

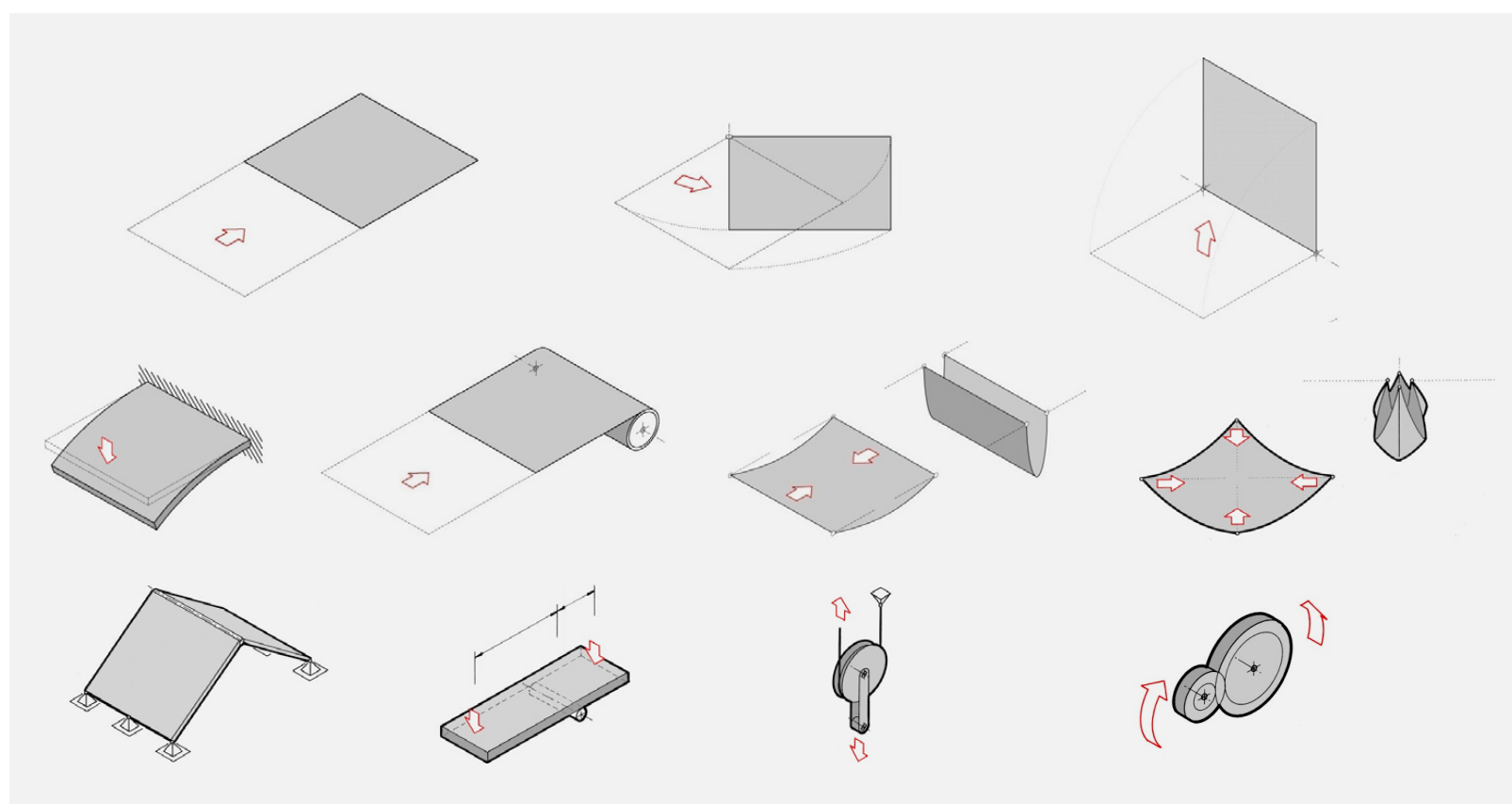


Point of origin: summary of **loadbearing principles** for vertical structures.

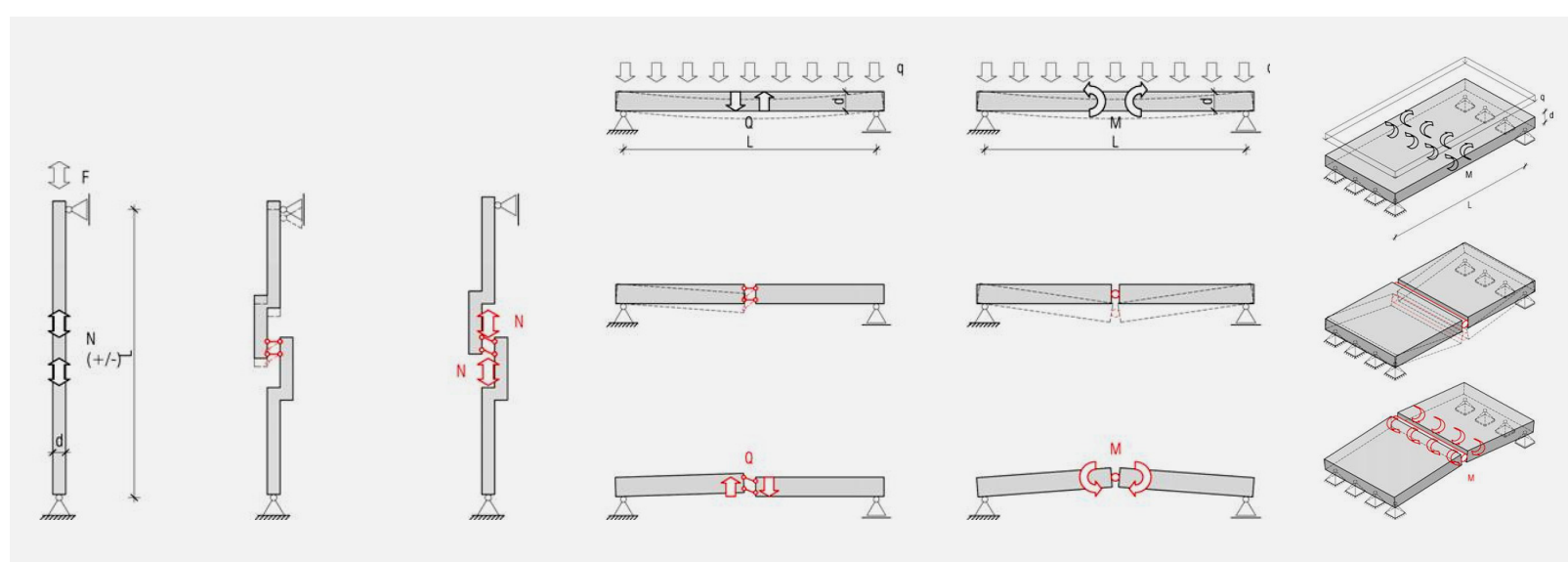
The novelty of this approach is the identification and exposure of essential load bearing principles in building structures and then to develop for each of the identified structural behaviors a measure to convert the static system into a kinetic mechanism.

In architecture the material defines the space boundaries. In contrast, in kinetic structures, like in dance, the space is activated by movement.

The essential feature of kinetic structures therefore is movement, which is governing also their principles.

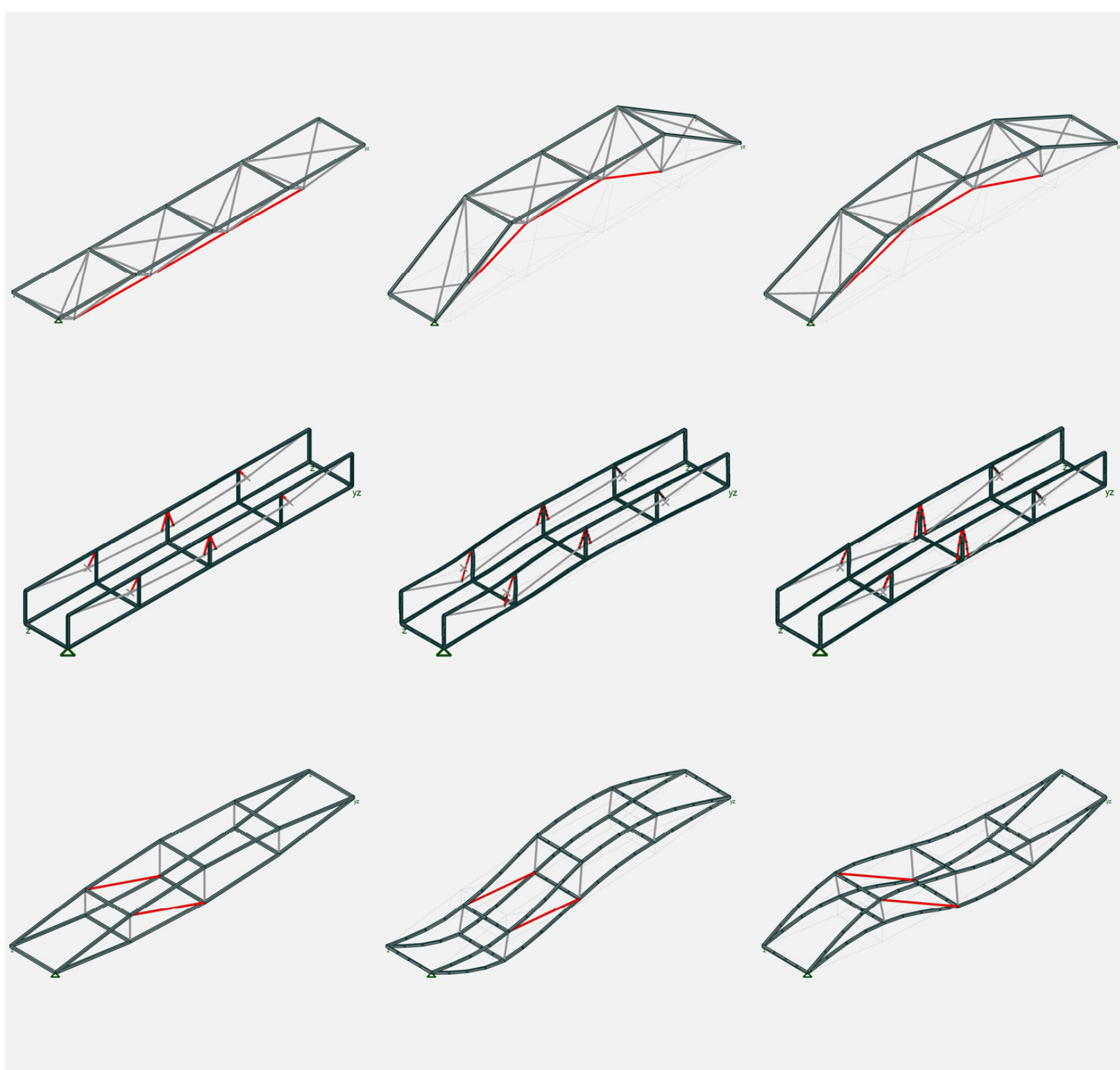


Movement occurs primarily either as parallel translation or rotary motion; **Flexible systems** allow bending, rolling, folding and gathering; **Rigid mechanisms** with hinge, lever, winding tackle and toothed gears.

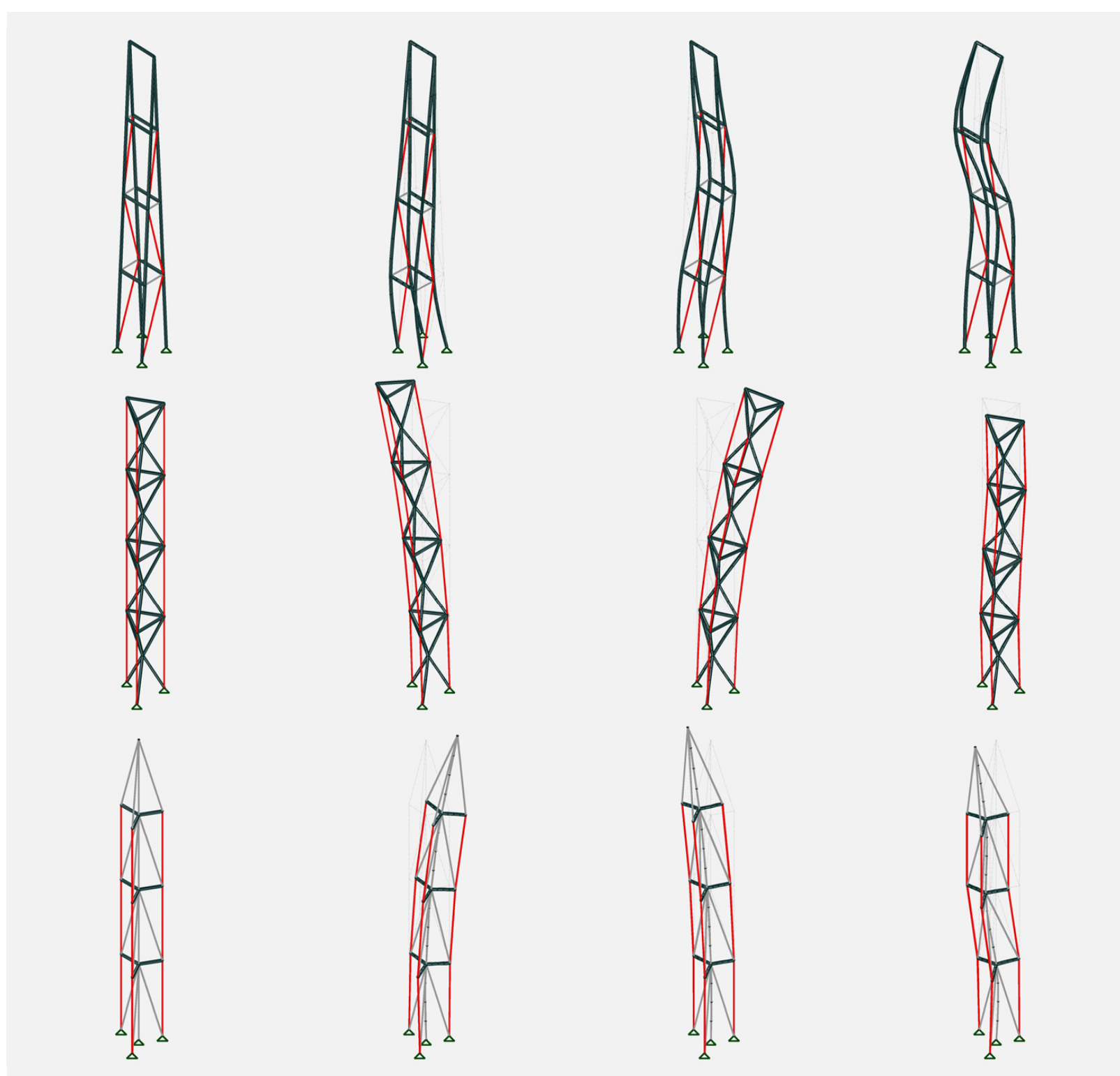


Kinetic modules releasing and actuating the main loadbearing principle: bar with axial force and actuation; beam releasing & actuating shear force respectively bending moment; and plate with bending moment release.

This methodical approach allowed developing several new kinetic structures. In the following reticulated frameworks are presented: connected with axial hinges or spherical joints and actuated with linear actuators, able of changing their geometry while maintaining load bearing functions.



Form-active horizontal structures: 3-chord truss with actuated lower chord – folding & arching its back; vierendeel girder with suspension cable and actuators; lenticular vierendeel revealing a fin-ray movement.



Form-active vertical structures: tapered vierendeel girder actuated in the characteristic fin-ray pattern; cable stayed mast / "dancing" spine and adaptive outrigger mast – both stabilized and actuated by cable stays.