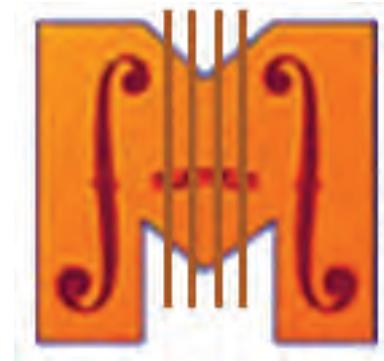


LV Physikalische Modelle

Physical Modeling with ModalysTM



Course overview

1 - Fri, 25.04.2008 - basic models

- overview
- general aspects of modal synthesis
- interfacing with Modalys™
- basic models
- combination models

2 - Fri, 16.05.2008 - finite elements

- finite elements
- 3D-wireframe models of structures

3 - Fri, 23.05.2008 - gesture control

- gesture control of physical modeling
- using continuous sensory data to control real-time Modalys™ synthesis

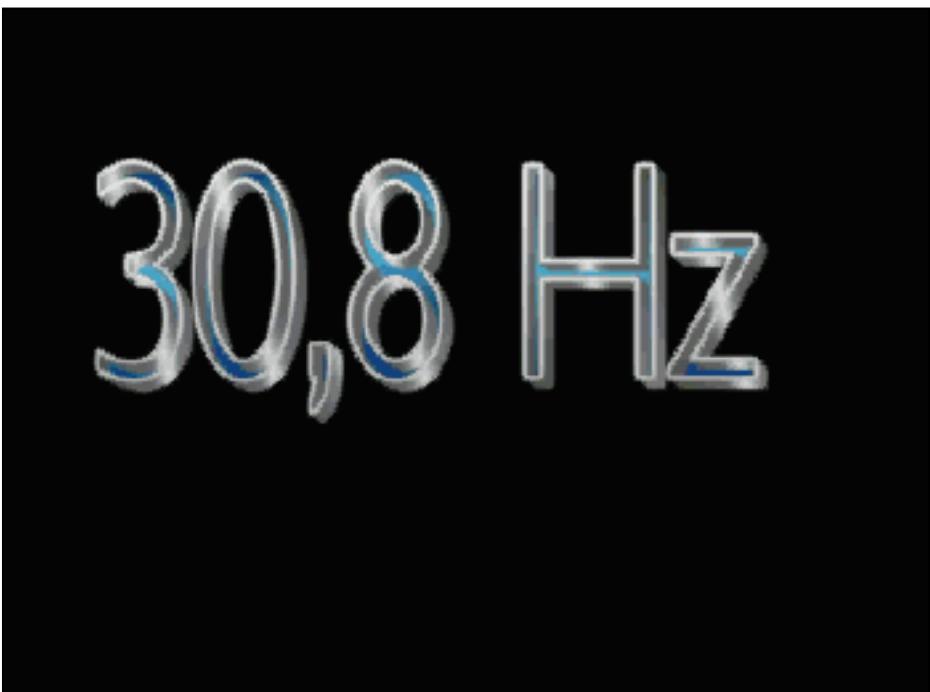
Resources

- general information about physical modeling (especially waveguide-synthesis)
<http://www-ccrma.stanford.edu/~jos/waveguide/>
(Julius O. Smith III, "Physical Audio Signal Processing for Virtual Musical Instruments and Audio Effects", August 2007 Edition)
- Modalys™ online-documentation
http://support.ircam.fr/doc-modalys/spip/page_garde.php3?
- PDF-Files (Ircam Documentation (modalys_docu.zip))
Modalys™ introduction, 3rd edition (english)
Modalys™ tutorial, 3rd edition (english)
Modalys™ reference, 3rd edition (english)
Modalys™ reference manual - finite elements objects (english)
Modalys™, trois exemples de constructions d'instruments (french)
- informations about Gongs (german only)
András Varsányi, "GONG AGENG - Herstellung, Klang und Gestalt eines königlichen Instruments des Ostens", Tübinger Beiträge zur Musikwissenschaft, Band 21, Schneider, Tutzing, 2000

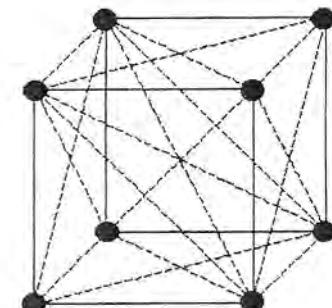
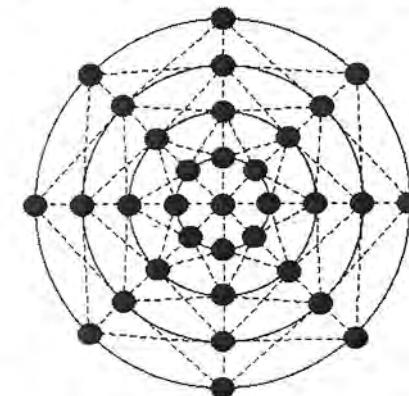
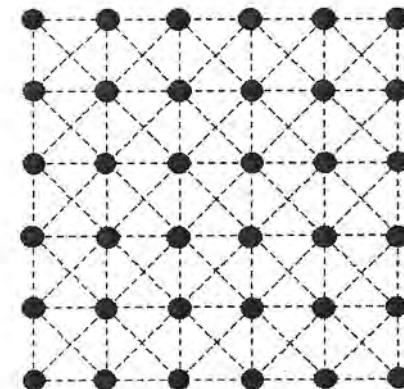
Physical Modeling with Modalys™

Modal Synthesis

- origin in the automotive industry and architecture
- opposite of modal analysis (link wikipedia)
- general
 - The harmonic reaction to an applied force can be calculated as long as the characteristic mass, frequency and damping of the structure are known.

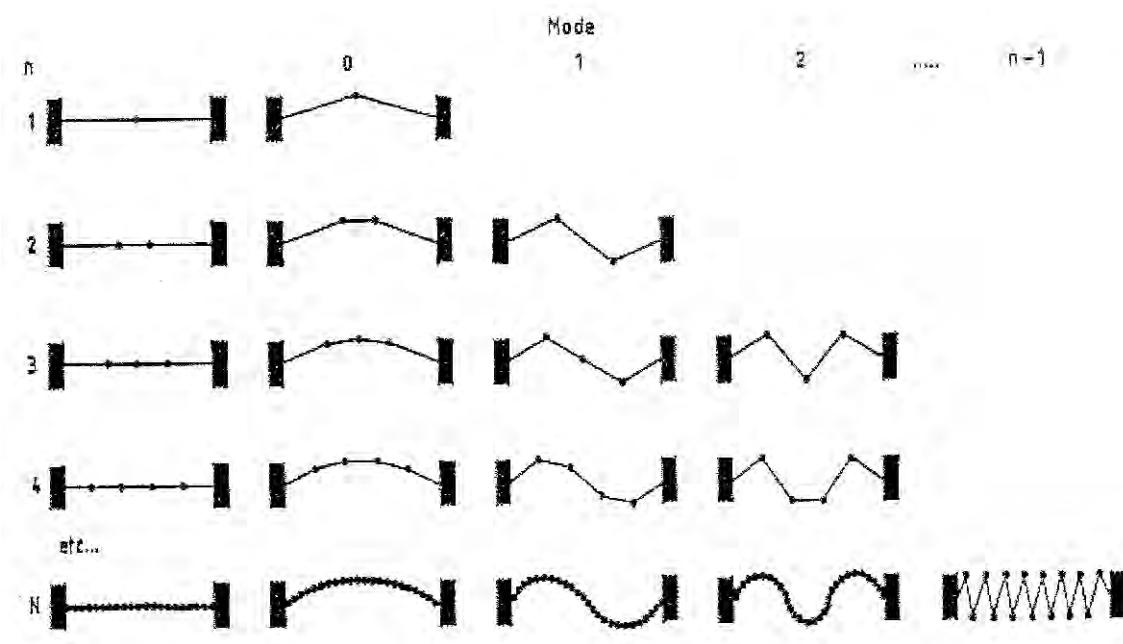


video displaying vibration of the body of a car

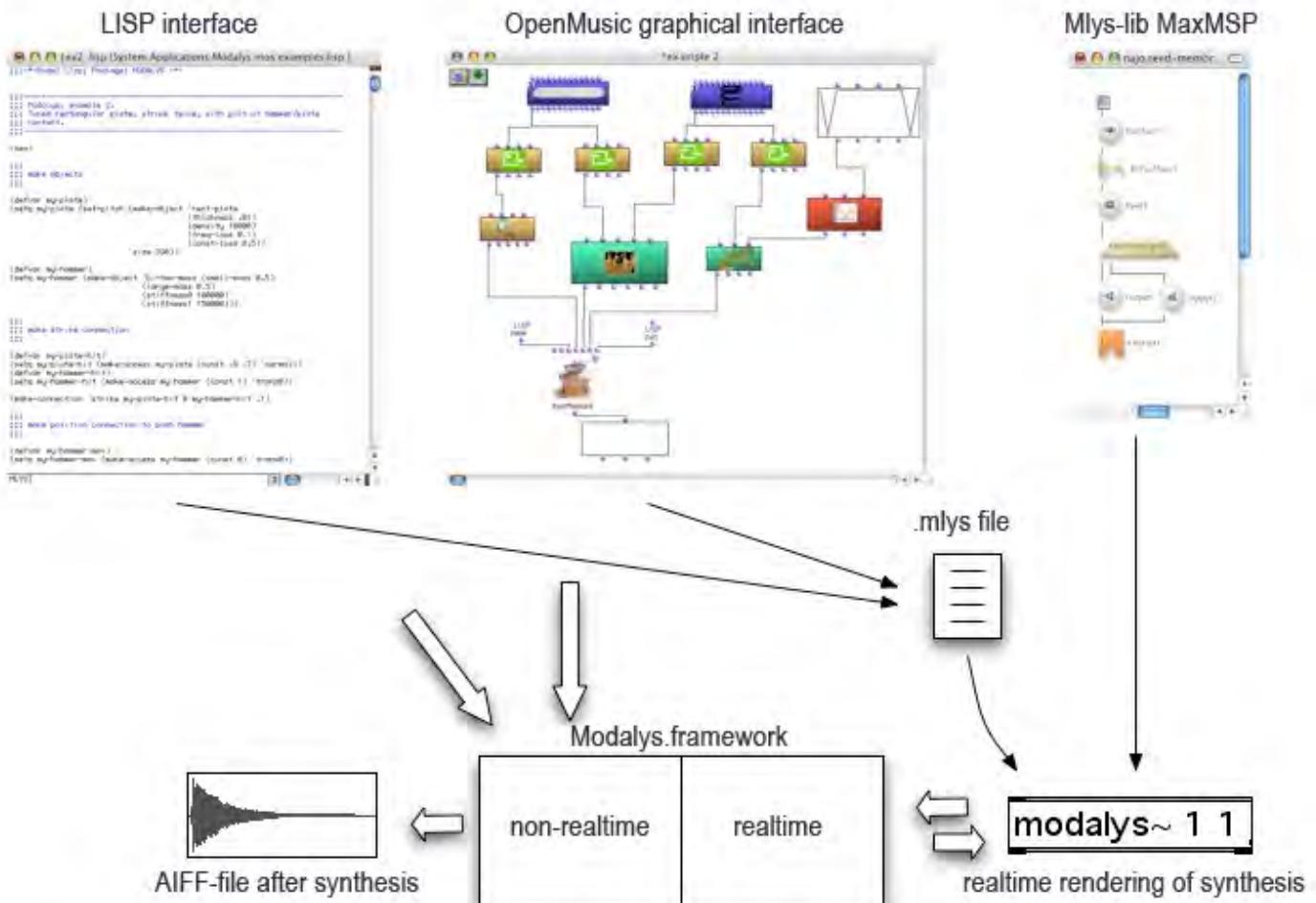


a plate (top), membrane (middle), body (bottom)
described with masses and springs

- masses and springs (applet)
 - all structures in Modalys™ can be displayed as networks of coupled masses and springs
- example string (display of modes) (applet)

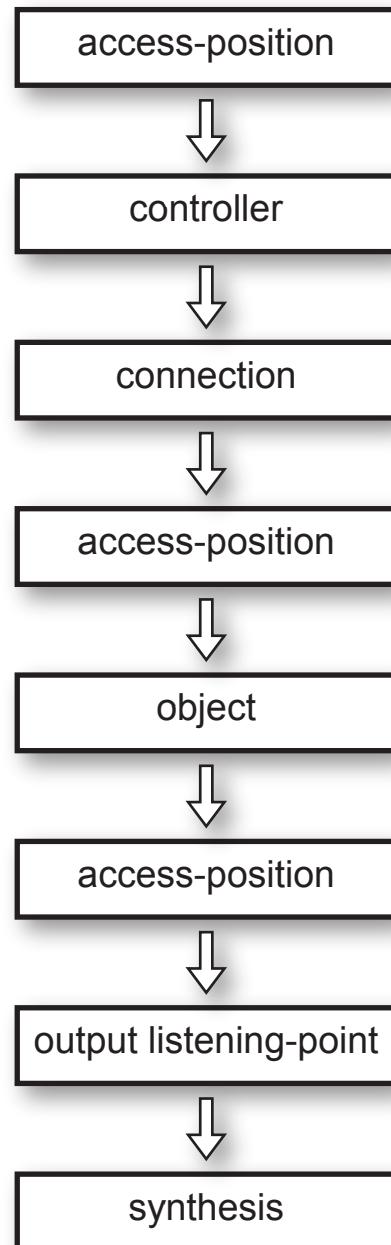


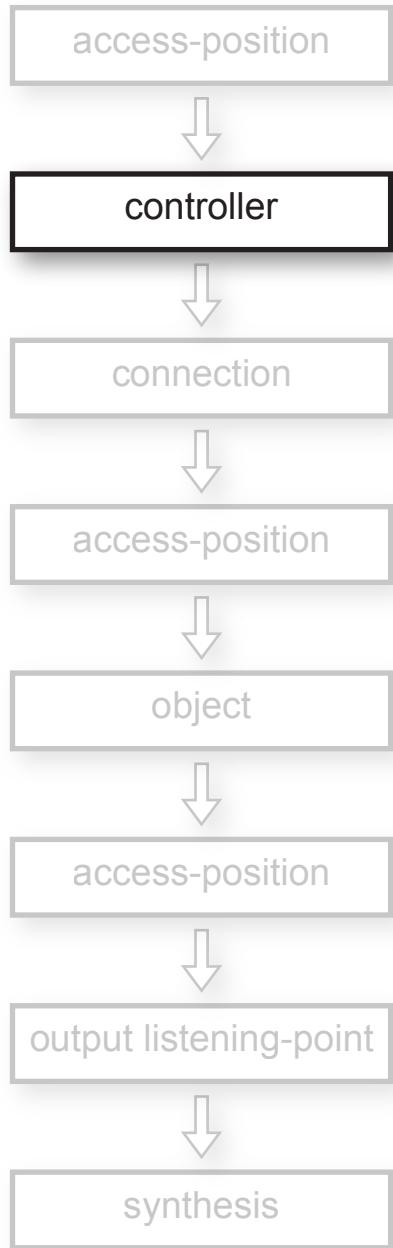
Interfaces



Instruments

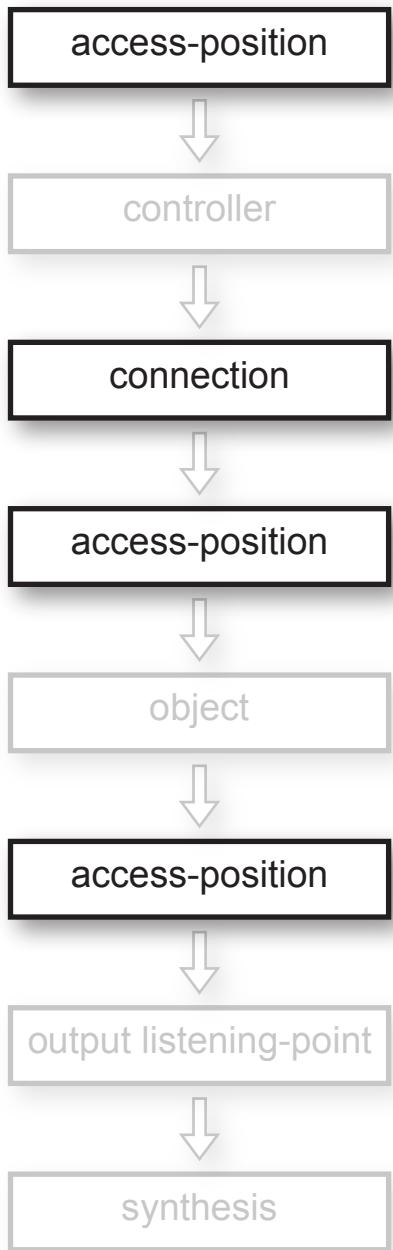
- hierarchy of an instrument in Modalys™





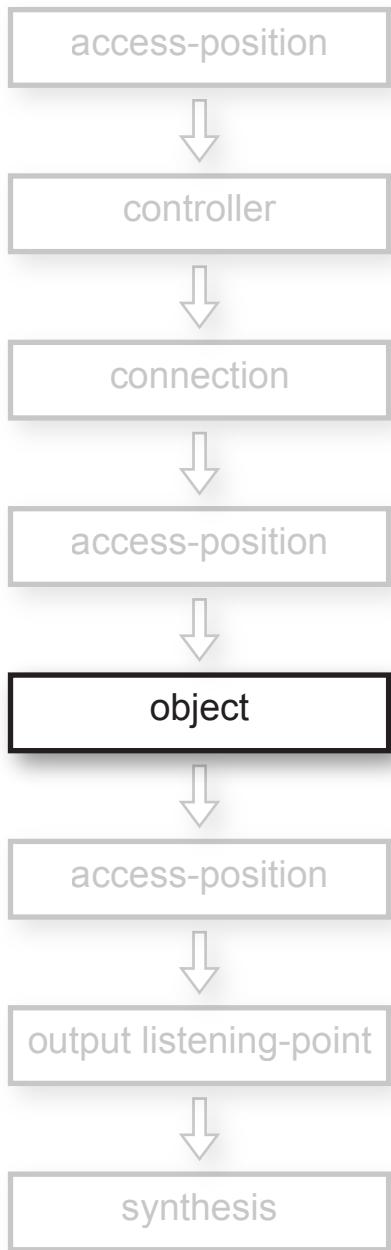
Controller (make-controller '...)

- envelope a BPF (break-point-function)
- dynamic controlled dynamically during the synthesis or externally
- signal controlled by an input signal
- band-limited-noise white noise limited by a bandpass-filter
- noise white noise (full bandwidth)
- random controlled by random values
- midi controlled from a MIDI-file
- foreign-call controlled by a Lisp-function defined in the program



Connections (make-connection '...')

- position an access-point on an object
- adhere “glue”-connection of two access-points
- spring connection of two access-points with a spring (coupled)
- force application of an input-force without a model
- pluck pluck the object
- strike striking the object with a hammer
- felt striking the object with a mallet
- bow exiting the object with a violin bow
- reed exiting the object with a single woodwind reed
- valve exiting the object with an trumpet embouchure
- reed-free exiting the object with an accordion reed
- hole a drilled hole similar to the flute



Objects (make-object '...)

- harmonic-oscillator a single mass and spring
- mono-two-mass a model of two masses connected with a spring moving in one direction
- bi-two-mass a model of two masses connected with a spring moving in two directions

- closed-closed-tube a tube closed at both ends
- closed-open-tube a tube closed at one end
- open-open-tube a tube open at both ends

- free-circ-plate a circular, non-fixed plate
- clamped-circ-plate a circular plate fixed around the edge
- rect-plate a rectangular plate
- rect-free-bar special case of a plate, similar to a vibraphone bar

- circ-membrane a circular membrane
- rect-membrane a rectangular membrane

- mono-string a string moving in one direction
- bi-string a string moving in two directions (necessary for bow-connection)

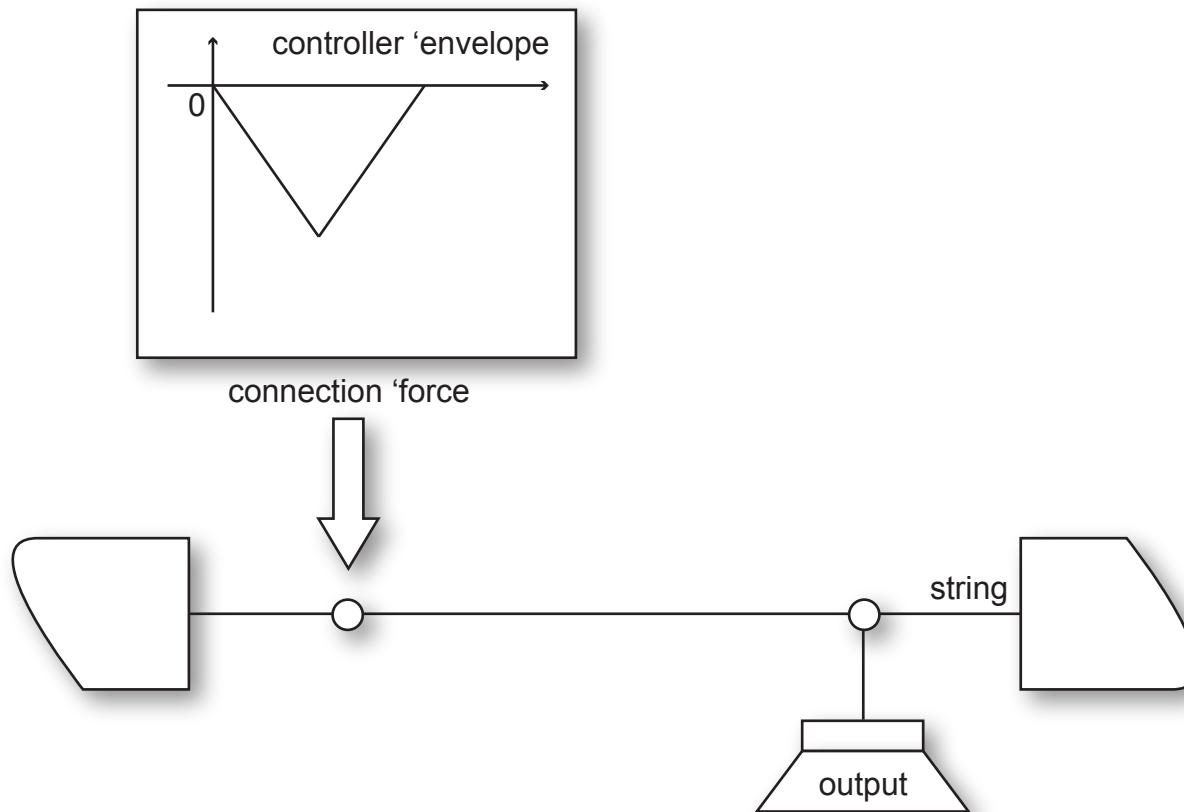
- cello-bridge a cello-bridge
- violin-bridge a violin-bridge

- clone an exact copy of an object
- melt-hybrid a hybrid of two regular objects by interpolation of modes
- mix-hybrid a hybrid of two regular objects by mixing
- reson-model a resonating filter from measurements

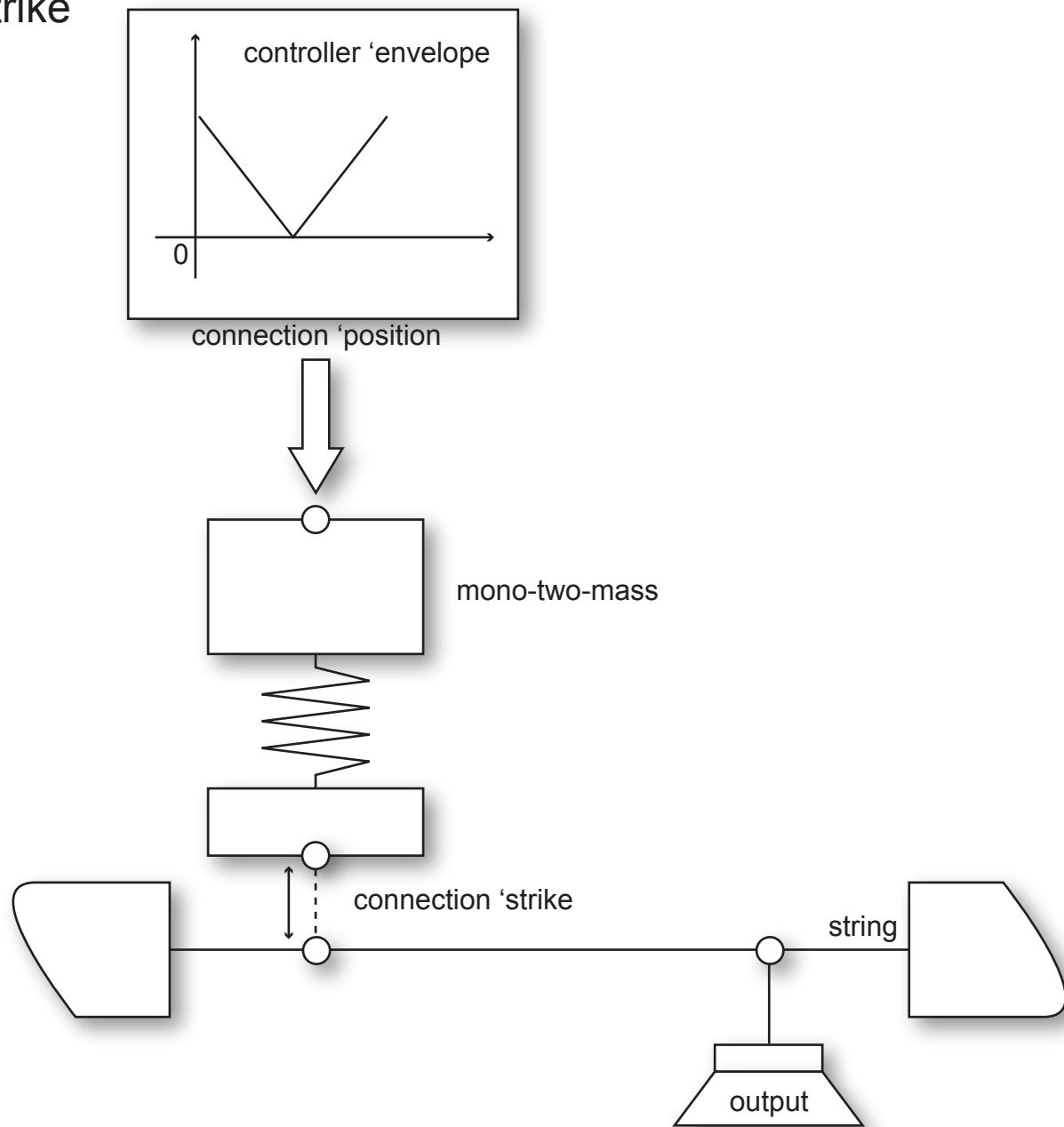
- finite-element an object based on a 3D-wireframe
- read-from-file an object from file (save-object ...)

Examples - basic models

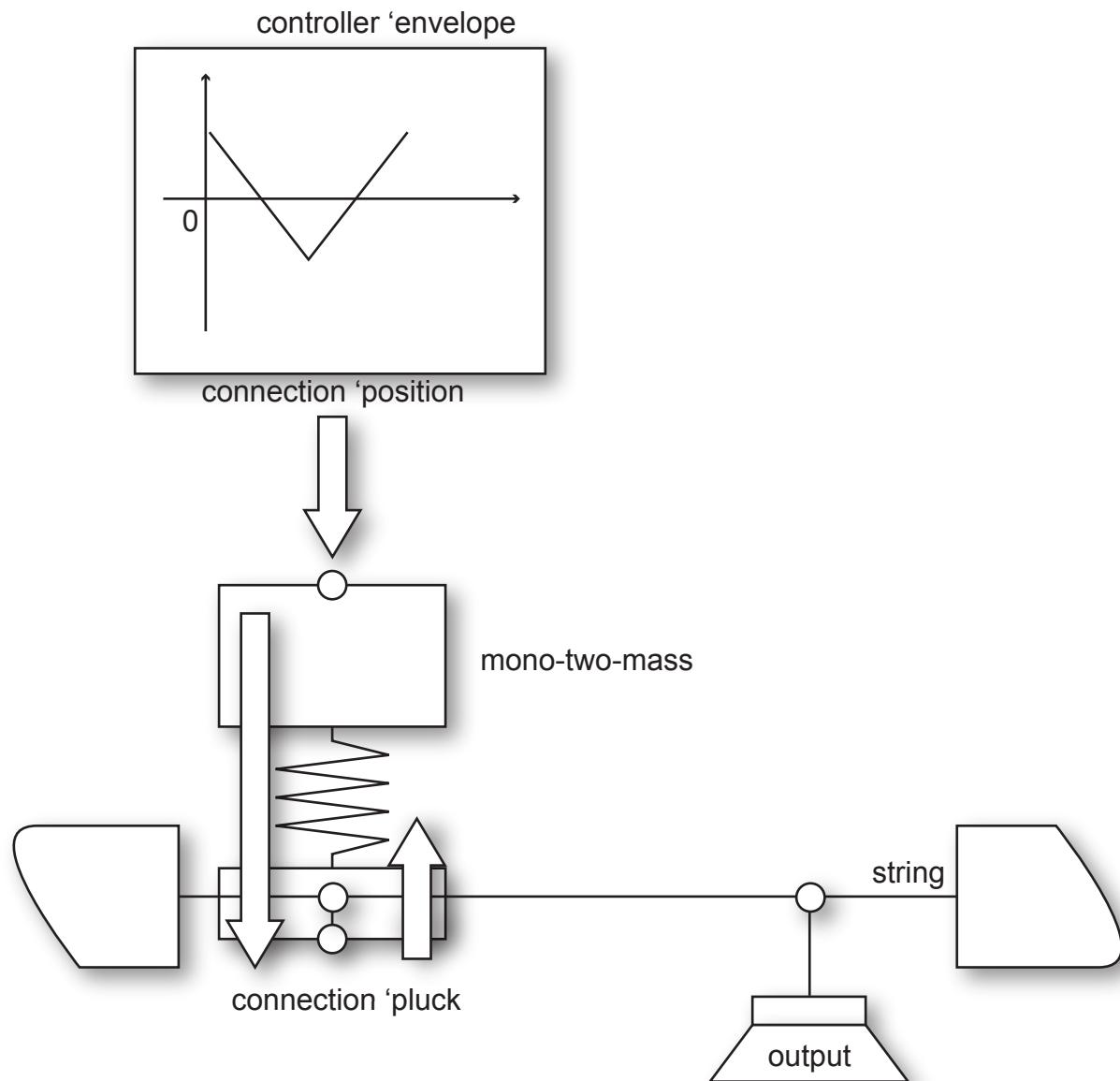
- string-force



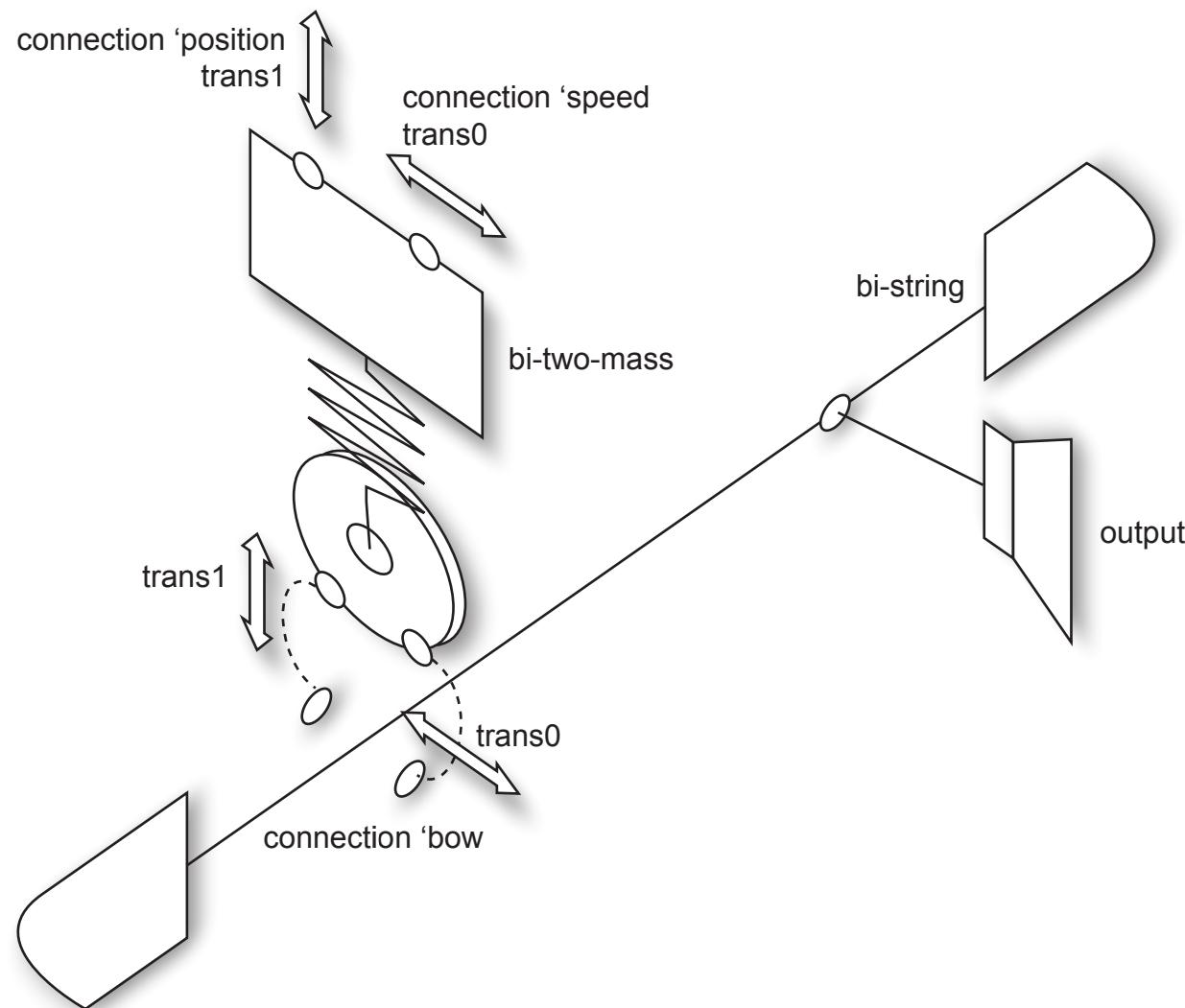
- string-strike



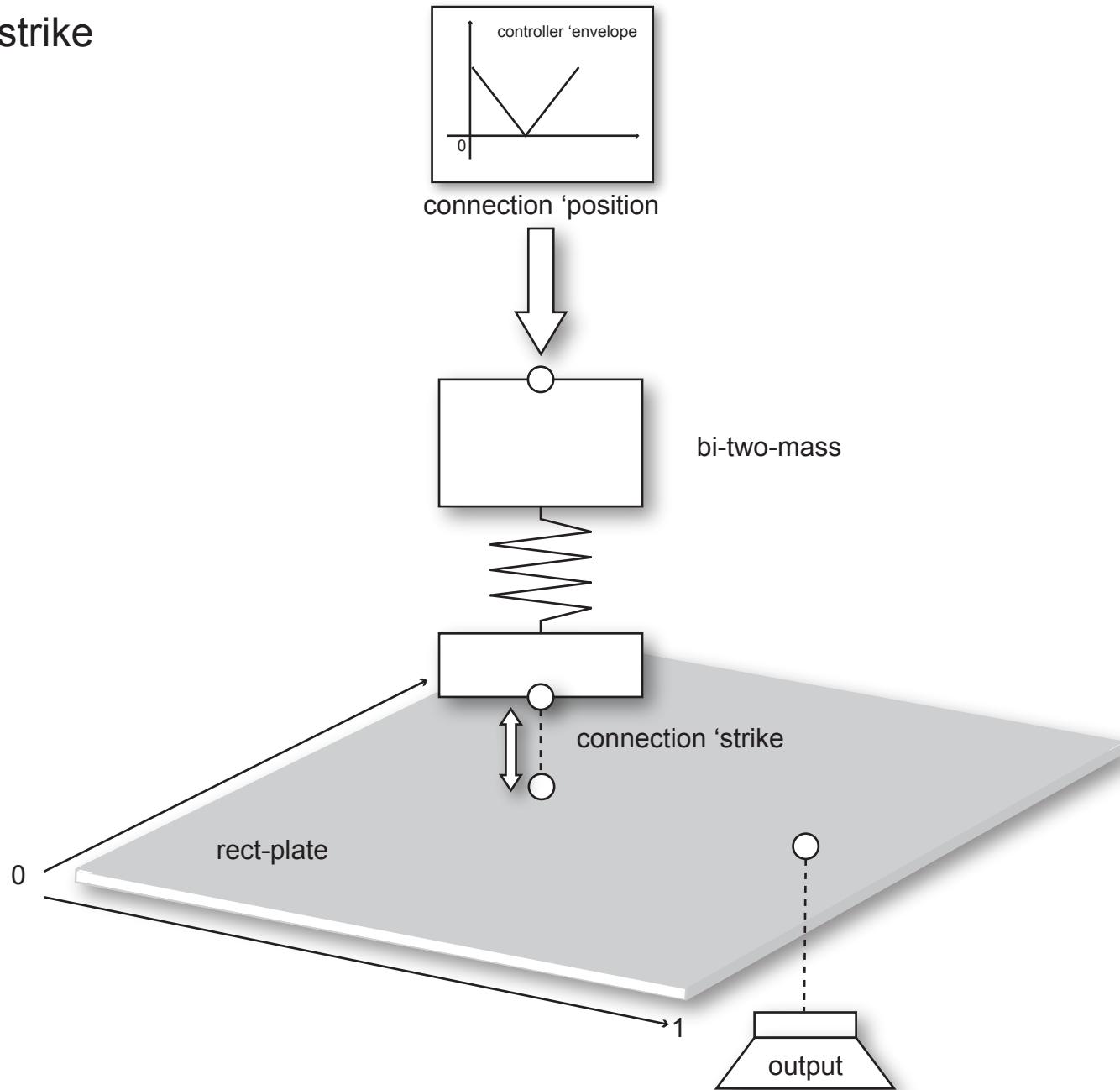
- string-pluck



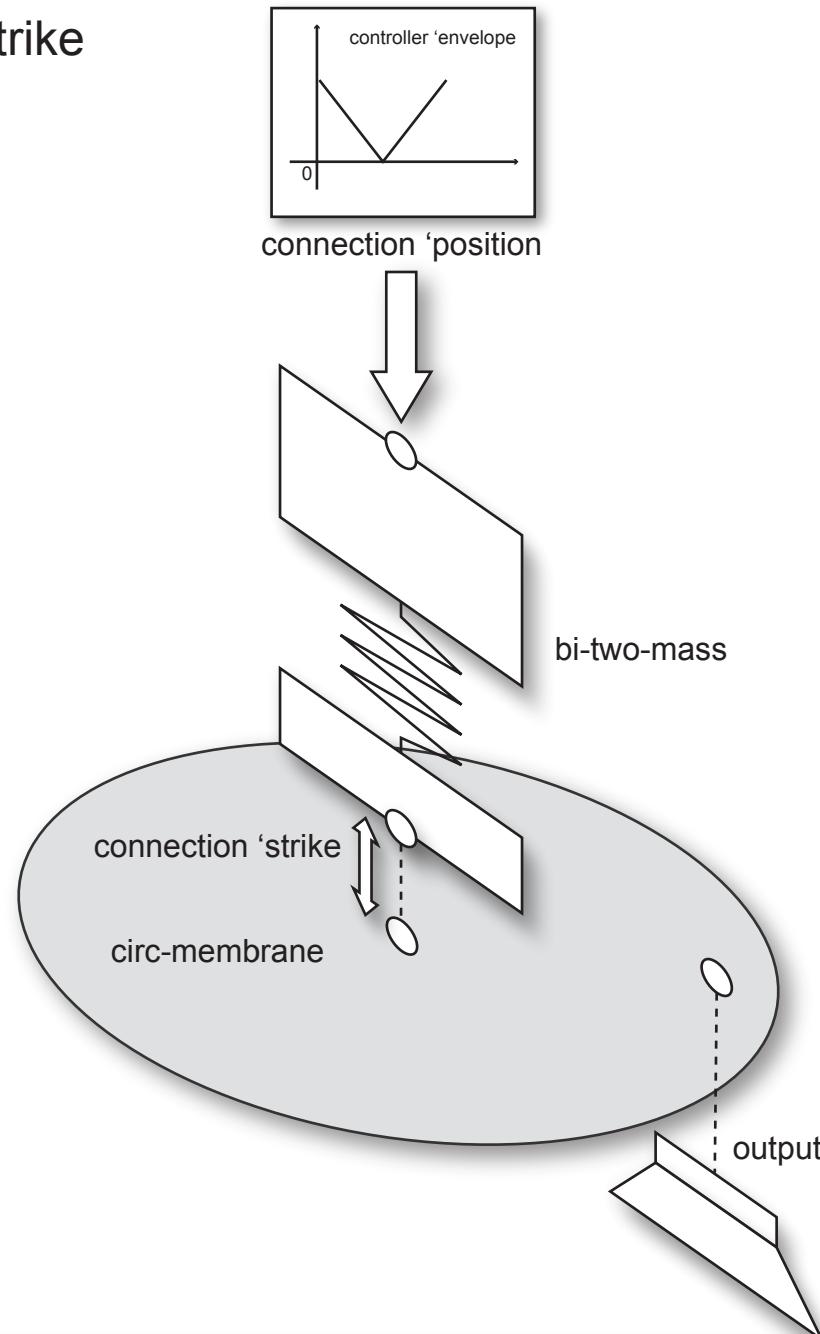
- bi-string-bow



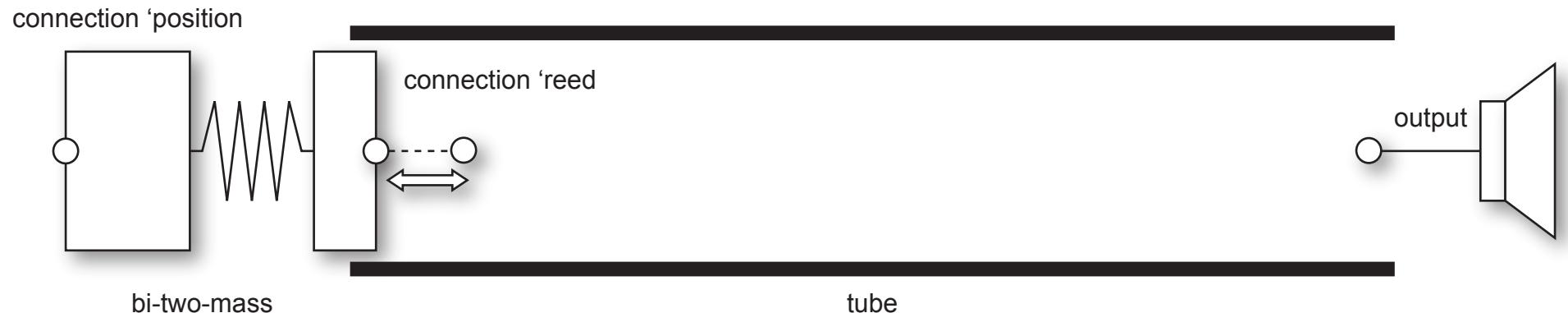
- plate-strike



- circ-membrane-strike



- reed-tube

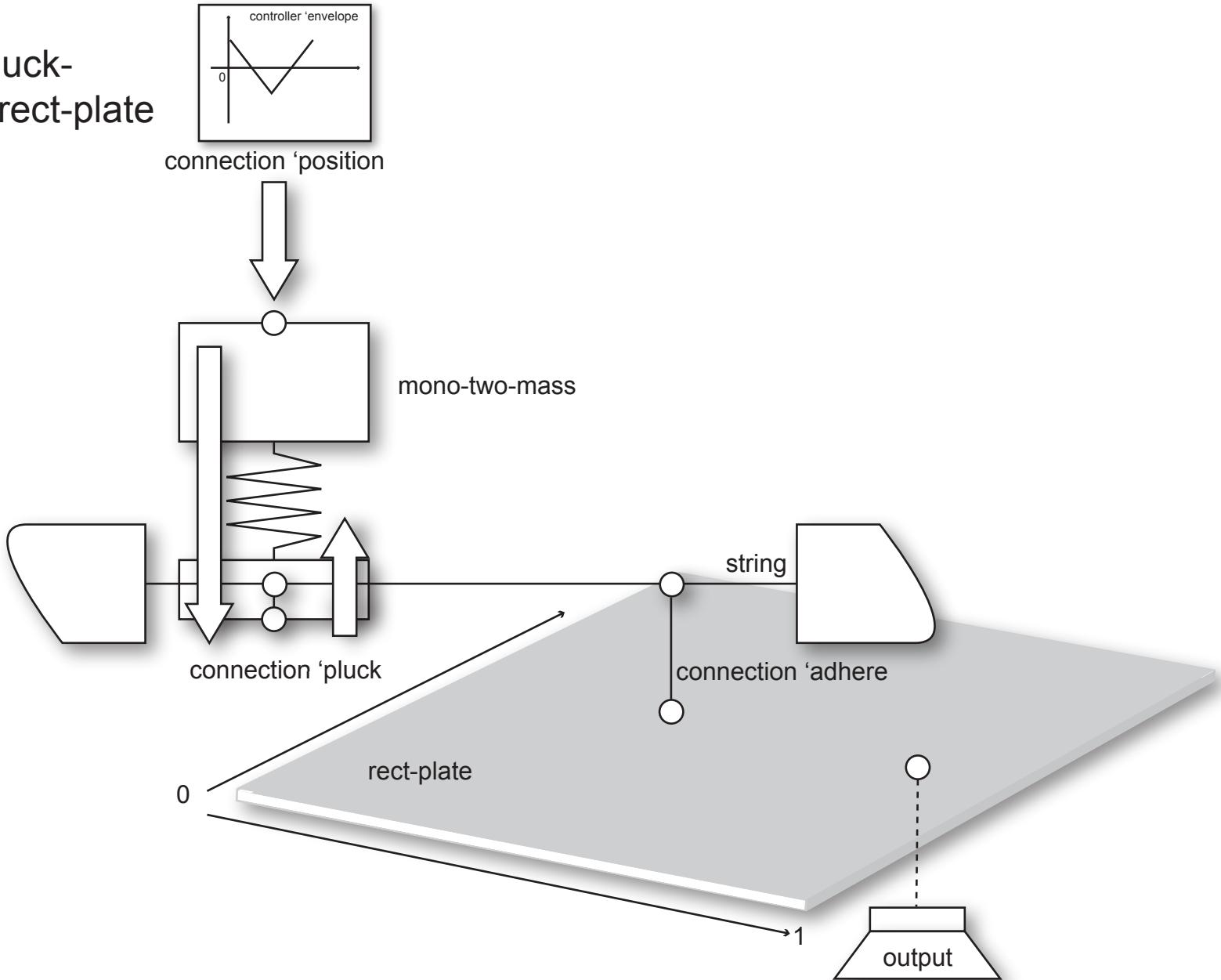


- examples without pictures

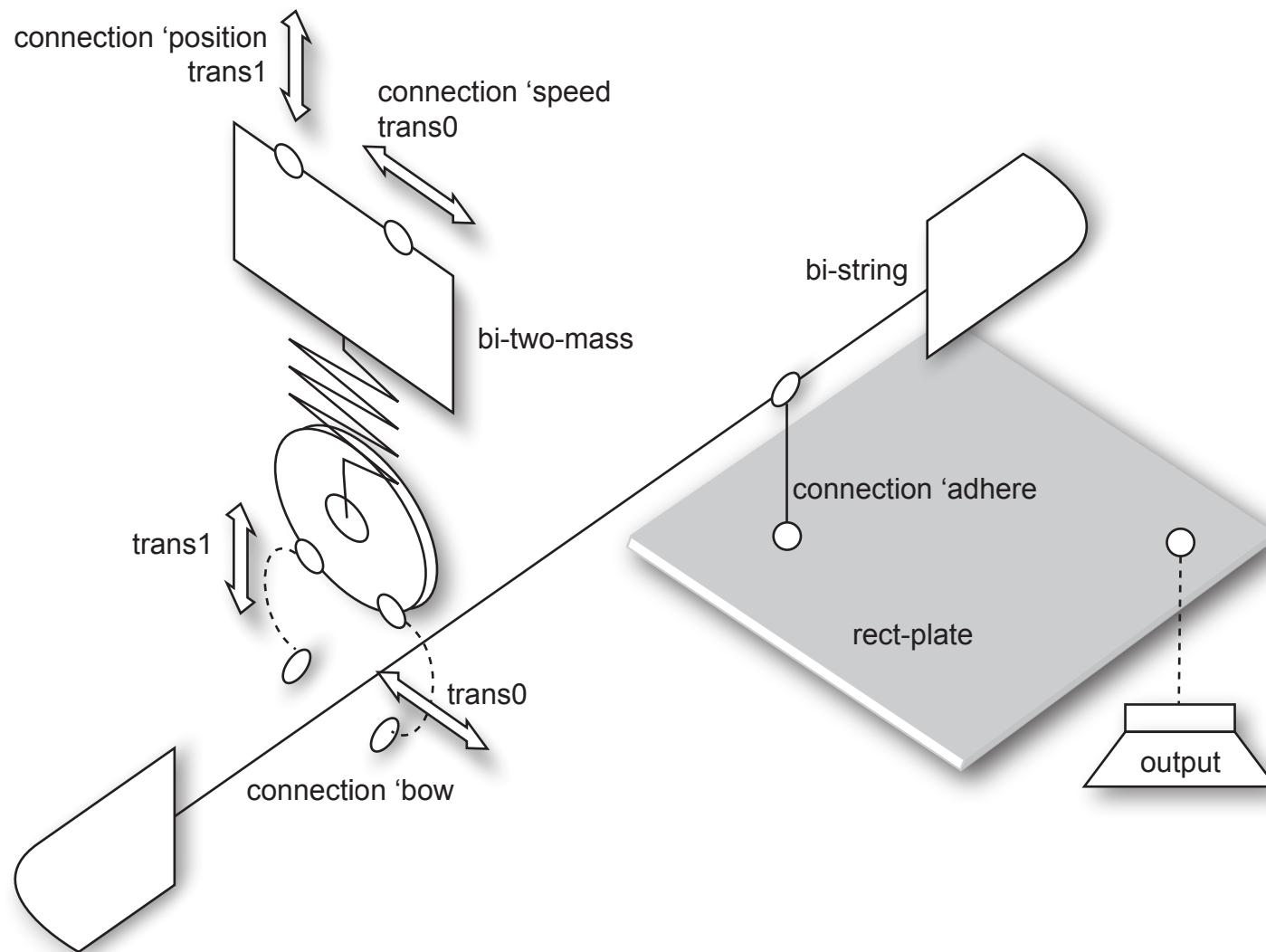
- plate-force
- plate-bow
- membrane-felt
- rect-membrane-strike
- rect-membrane-felt

Combination models - adhere

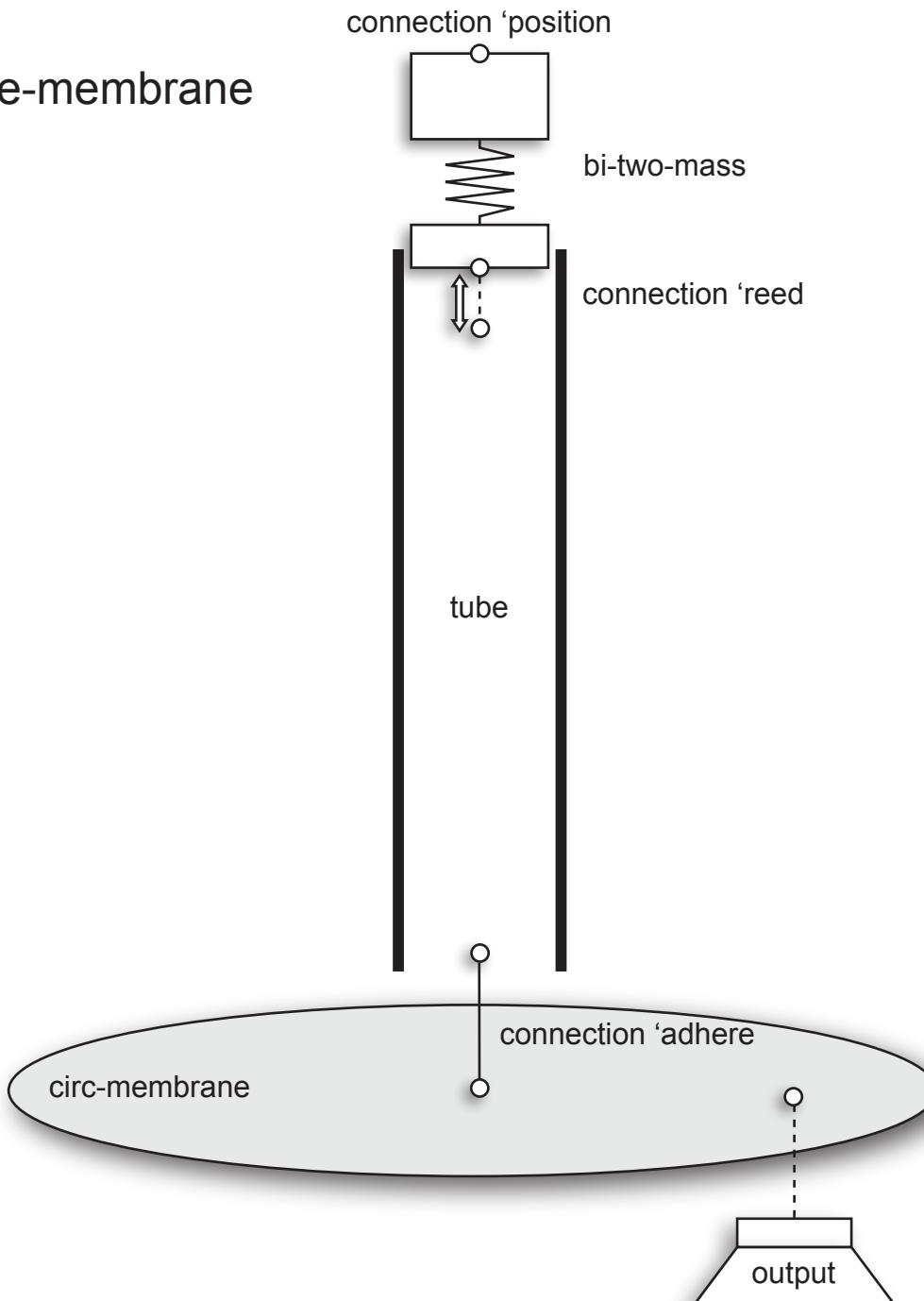
- string-pluck-adhere-rect-plate



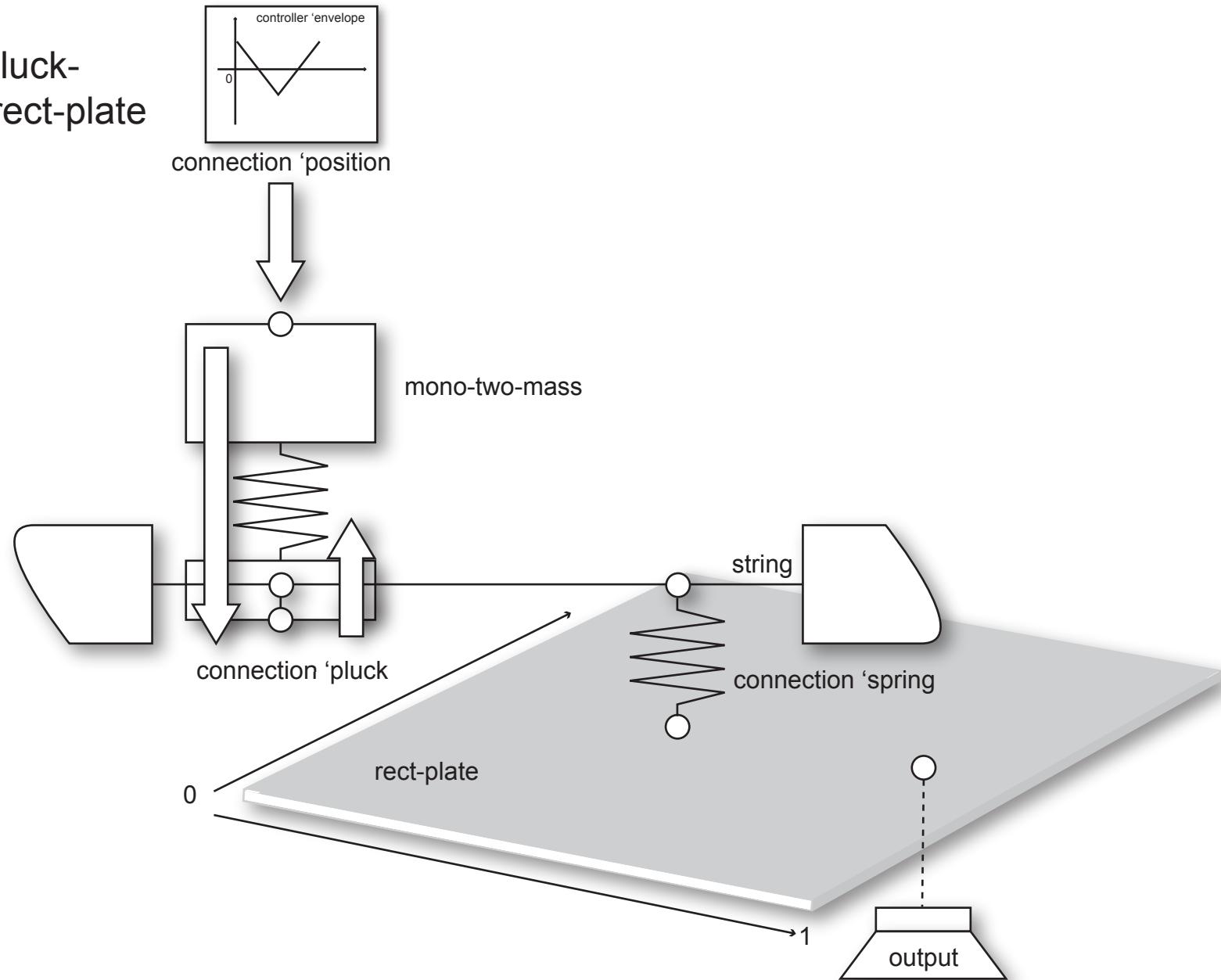
- string-bow-adhere-rect-plate



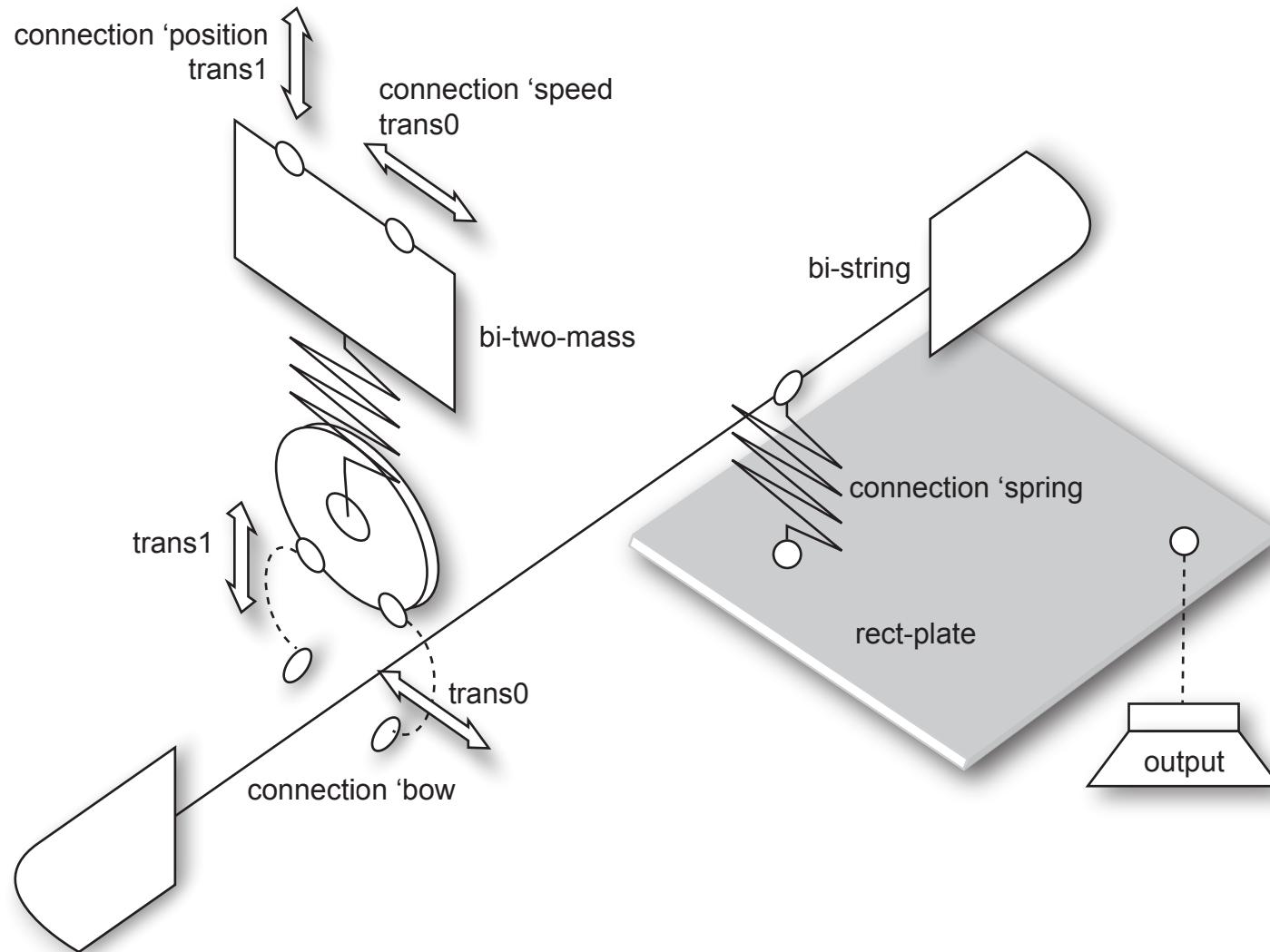
- reed-tube-adhere-membrane



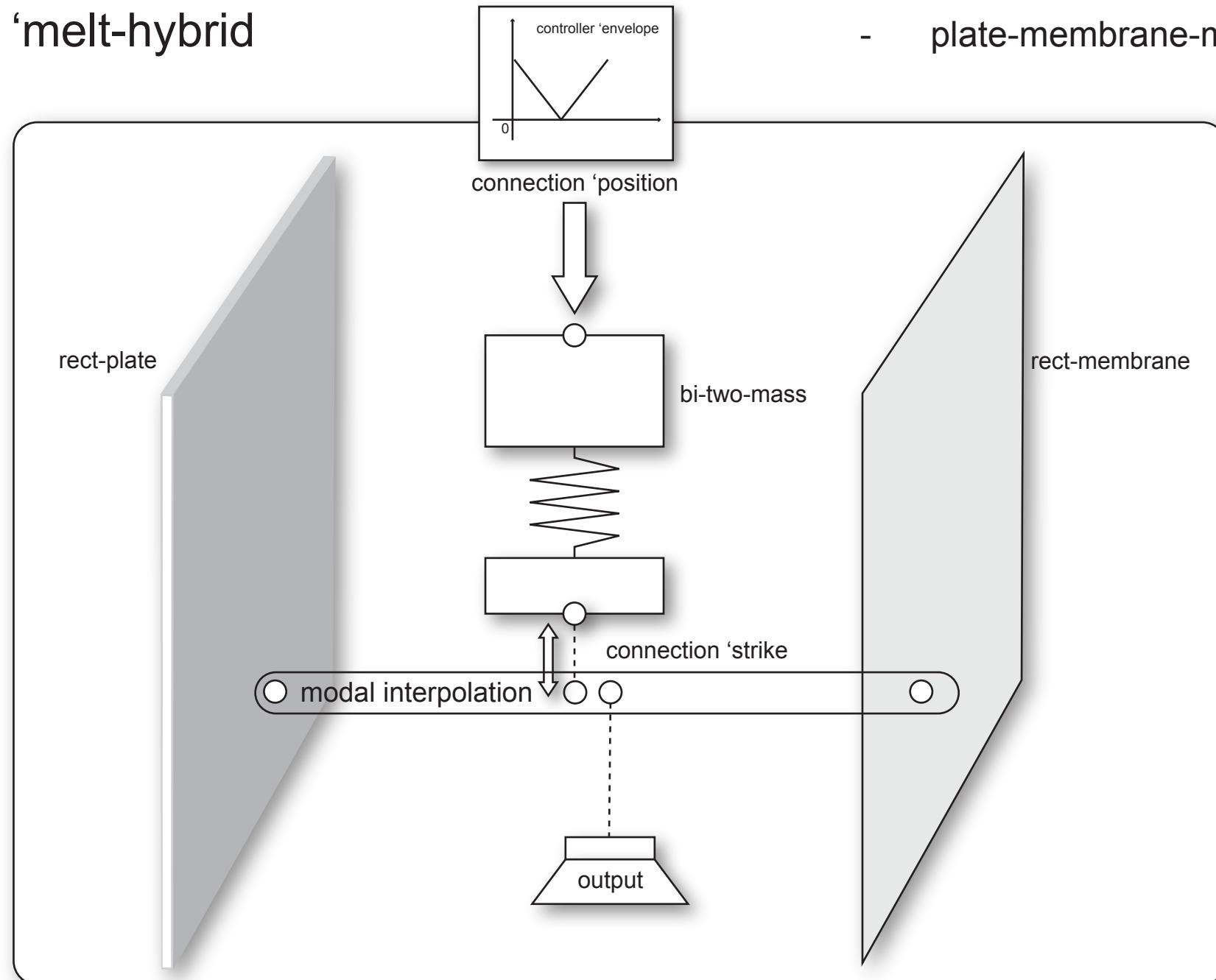
- 'spring
- string-pluck-spring-rect-plate



- string-bow-spring-rect-plate

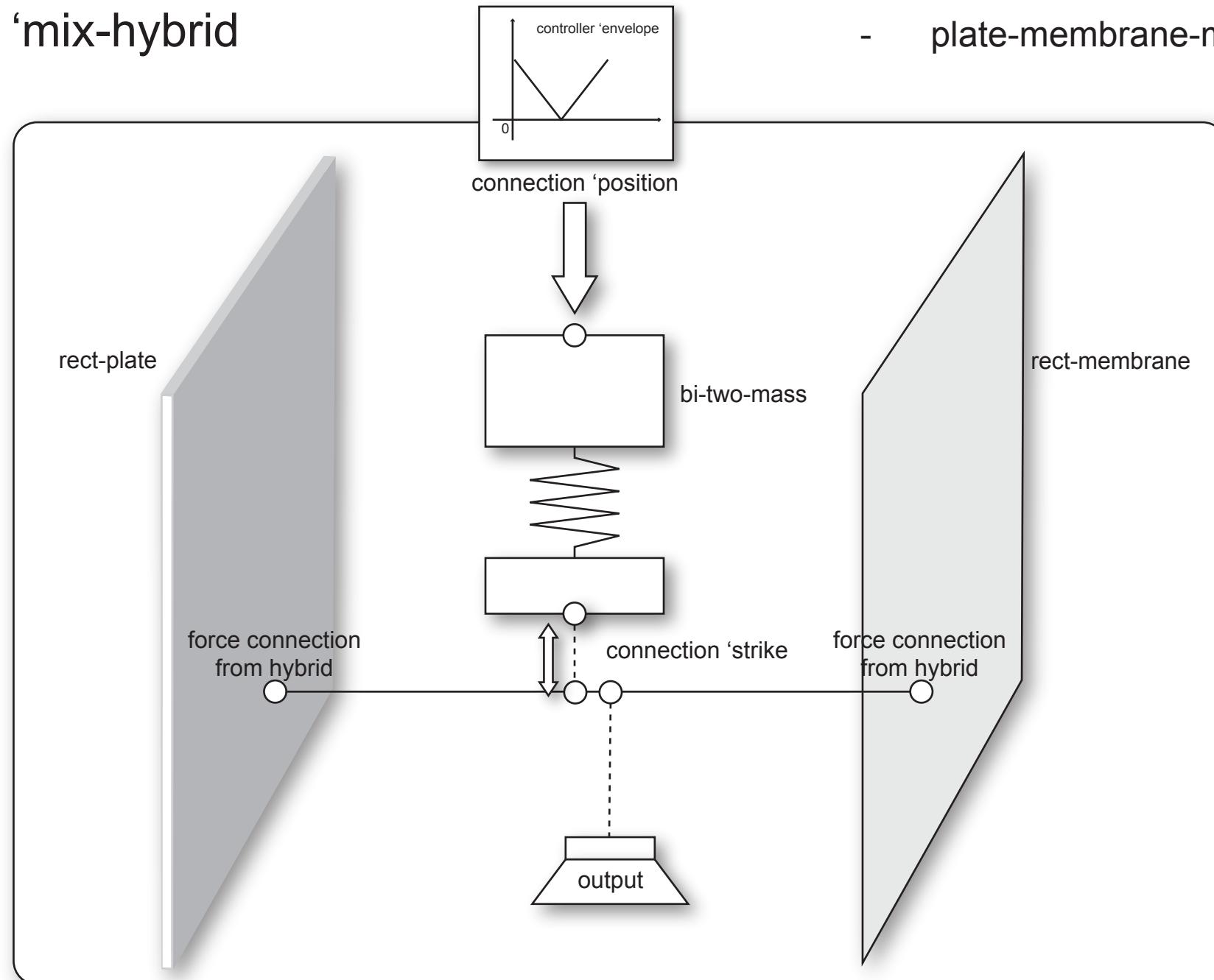


- 'melt-hybrid



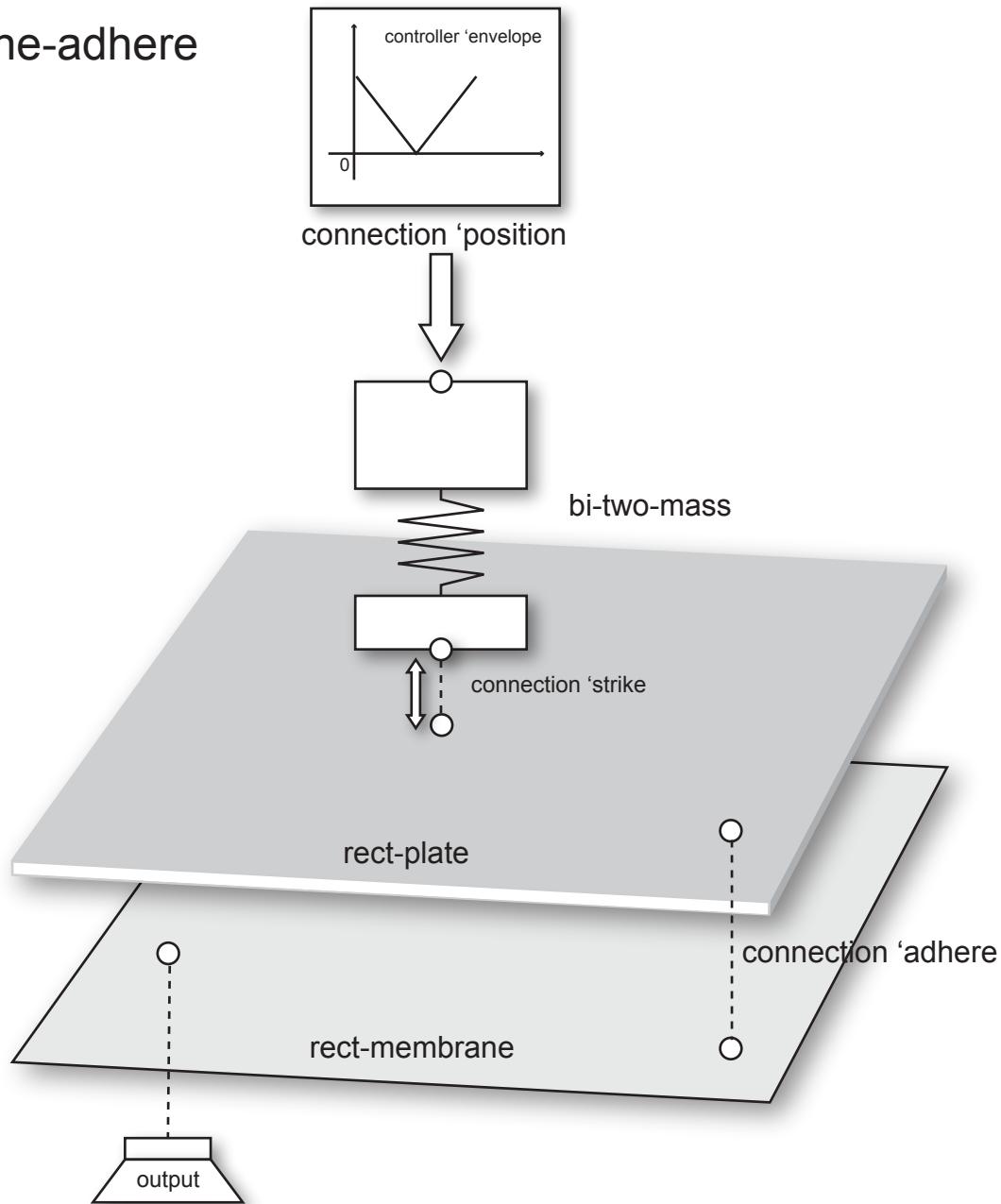
- plate-membrane-melt-hybrid

- 'mix-hybrid



- plate-membrane-mix-hybrid

- plate-membrane-adhere



- plate-membrane-spring

