MechaTrans Technical Notes

1. Displacement and force to be generated

The relation between the displacement and the force to be generated is shown in Fig.1. The displacement ξ*s* at the mechanical output point of MechaTrans® is obtained when 100 [V] of the recommended voltage is supplied onto MechaTrans® without any external load, namely free condition. The force *Fs* is generated when 100 [V] is supplied and the output point is fixed. The gradient of the line *Ks*=*Fs* /ξ*s* is represented as the rigidity of MechaTrans® whereas the area of the triangle 0-*Es* -ξ*s* indicates the energy*Es* to be produced by MechaTrans® itself.

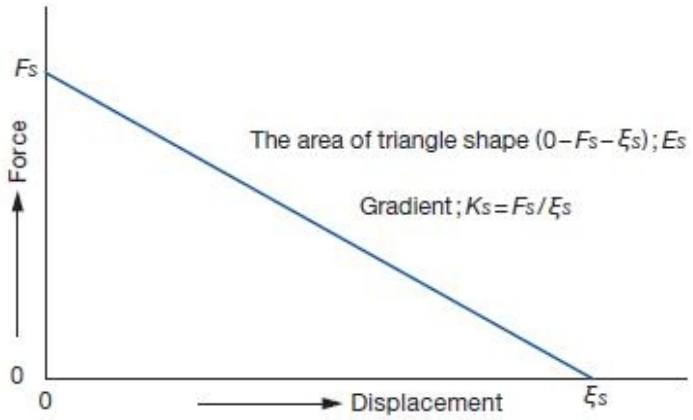

Fig. 1 Relation between the displacement and the force

2. Characteristics under static conditions

The displacement of MechaTrans® to be generated is shown in Fig.2 when it is used under a static loading condition such as spring constant.
If the load rigidity *Kx* to MechaTrans® is equal to the rigidity of Mechatrans® *Ks*, the displacement of MechaTrans® should be half of the free condition. If *Kx* is larger than *Ks*, the displacement should be less than half of the free condition, and if *Kx* is smaller than *Ks*, the displacement should be more than the half.
The energy of the loading side given by MechaTrans® should be maximized when *Kx* is equal to *Ks* and it is a quarter of the total energy of MechaTrans® itself shown as Fig.1.

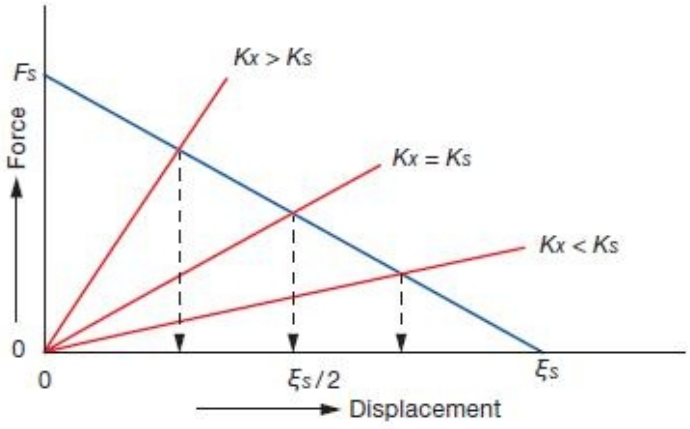

Fig. 2 Relation between load and generated displacement

Performance under a dynamic loading force

A mechanical resonance system is made up of both a loading mass *M* and rigidity of MechaTrans®. The resonance frequency can be calculated from the following equation.

$$f = \frac{1}{2\pi}\sqrt{\frac{Ks}{M}} \qquad (1)$$

Here the units are, f:Hz, Ks:N/m, M:kg.

n this case, the *M* is very important to the resonance frequency of MechaTrans® itself and the *M*consists of both the mass at the output point of MechaTrans® and the mass of the loading side. When a step voltage is supplied to MechaTrans®, the maximum kinetic energy to be given to *M* on the transient phenomenon should be equal to the own energy of the piezoelectric device. That means the energy difference between dynamic conditions and static conditions is not so small. When MechaTrans® is used under dynamic conditions, it is required to receive our technical consultation because MechaTrans® may be damaged in the worst case unless appropriate treatments are given to MechaTrans®. Please refer to **"Operating precautions for MechaTrans®>4)Do not superimpose DC voltage instantaneously"**.