■ Constant system parameters

■ General values

All values are given in standard SI units!

Permeability of Vacuum (w/o units):

```
val0 = {
  μ0 -> VacuumPermeability / (Volt Second / (Ampere Meter))}
```

$$\left\{\mu 0 \to \frac{\pi}{2500000}\right\}$$

Properties of the rod (radius of coil = radius of solenoid).

```
val1o = {
  ER → 280 * 10^9,          (*E-modulus of rod in Pa*)
  cR → 5391,                (*sound velocity in meter/second*)
  ϴ → -5 * 10^6,            (*Magnetostrictive constant in xxxxxxxxxx*)
  μrR → 110}                 (*relative permeability rod*)
```

$$\{\text{ER} \to 280000000000,\ \text{cR} \to 5391,\ \theta \to -5000000,\ \mu\text{rR} \to 110\}$$

Properties of the function generator:

```
val2o = {
   U0d → 4,              (*Amplitude in Volt (NOT peak-peak!)*)
   Ri → 50}               (*Internal resistance in Ohm*);
```

```
val3o = {
    A → π r^2,
    μR → μ0 * μrR} /. Flatten[{val0, val1o}];

valueso = Flatten[{val0, val1o, val2o, val3o}]
```

$$\left\{\mu 0 \to \frac{\pi}{2500000},\ \text{ER} \to 280000000000,\ \text{cR} \to 5391,\ \theta \to -5000000,\ \mu\text{rR} \to 110,\ \text{U0d} \to 4,\ \text{Ri} \to 50,\ \text{A} \to \pi\, \text{r}^2,\ \mu\text{R} \to \frac{11\,\pi}{250000}\right\}$$

Now the values are applied onto the coefficients a1 and a2, generating new rules:

```
valuerulea1o = rulea1 /. valueso;

valuerulea2o = rulea2 /. valueso;
```

```
generalruleao = Flatten[{valuerulea1o, valuerulea2o}]
```

$$\left\{a1 \to -\left(5391\ \text{dd}\ \text{Ud}\left(-280000000000\,\pi\,r^2 + 280000000000\,\pi\,r^2\,\text{Cos}\left[\frac{\text{lRod}\,w}{5391}\right] + 5391\,i\,\text{ZC}\,\text{Sin}\left[\frac{\text{lRod}\,w}{5391}\right]\right)\right) \Big/ \left(56000\,\text{N}\,\pi\,r^2\,w^2\left(5391\,\text{ZC}\,\text{Cos}\left[\frac{\text{lRod}\,w}{5391}\right] + 280000000000\,i\,\pi\,r^2\,\text{Sin}\left[\frac{\text{lRod}\,w}{5391}\right]\right)\right),\ a2 \to \frac{5391\,i\,\text{dd}\,\text{Ud}}{56000\,\text{N}\,\pi\,r^2\,w^2}\right\}$$

■ HP FGen

```
generalruleUd = ruleUd /. valueso;
```

The following rule sets a1 and a2 for the HP funktion generator. Open is: Zc, w, N, x1, lCoil1, lRod, r

```
generala = Simplify[generalruleao /. ruleUd /. valueso];
```

■ Magnetostrictive Rod properties:

```
rod = {lRod → 40.8 / 1000, r → 1 / 1000};
```

■ Coil properties

```
coils = {lCoil1 → 12 / 1000, N → 450, K1 → 10 / 10, x1 → 14 / 137 * lRod,
   lCoil2 → 12 / 1000, N2 → 140, K2 → 0.002379 * 1 / 10, x2 → 76 / 137 * lRod};
```

■ General rule

```
general = Flatten[{coils, rod, generala, generalruleUd, valueso, w → 2 π f}];
```

■ Calculating natural resonance frequencies for rod

■ test the power