These are the equations to solve for the four coefficients in Caughy 4th damping from the 4 natural frequencies.
Natural frequencies are obtained from the eigen-solver in ESSI.
User can define the ξ by themselves.

In[1]:=
```
ξ = 0.2;
w1 = 2 Pi * 0.407108;
w2 = 2 Pi * 0.552311;
w3 = 2 Pi * 1.6776;
w4 = 2 Pi * 2.57922;
Solve[{ξ == a0 / 2 / w1 + a1 / 2 * w1 + a2 / 2 * w1^3 + a3 / 2 * w1^5,
  ξ == a0 / 2 / w2 + a1 / 2 * w2 + a2 / 2 * w2^3 + a3 / 2 * w2^5,
  ξ == a0 / 2 / w3 + a1 / 2 * w3 + a2 / 2 * w3^3 + a3 / 2 * w3^5,
  ξ == a0 / 2 / w4 + a1 / 2 * w4 + a2 / 2 * w4^3 + a3 / 2 * w4^5}, {a0, a1, a2, a3}]
```

Out[6]=
$$\{\{a0 \to 0.550017,\ a1 \to 0.0756472,\ a2 \to -0.000517195,\ a3 \to 1.20005 \times 10^{-6}\}\}$$