```
> restart:
```

```
> S:=(DRL+DRA)/DRL;DRL:=P1*L2/A1-P1*L1/A1;DRA:=P1*L1/A2-P1*L1/A1;
```

$$S := \frac{DRL + DRA}{DRL}$$

$$DRL := \frac{P1\, L2}{A1} - \frac{P1\, L1}{A1}$$

$$DRA := \frac{P1\, L1}{A2} - \frac{P1\, L1}{A1}$$

S is gauge factor which is defined here as "the change in resistance due to strain extension *and* lateral contraction due to the attendant Poisson's effect divided by change in resistance due to extension alone, as if mu=0". Read DRL as delta Resistance due to length change and DRA as delta Resistance due to area change. P1 is resistivity; a coefficient relating electrical resistance to proportionality to length L and inverse proportionality to cross section area A of the conductor. 1 means initial, 2 means changed. It is assumed here that resistivity doesn't change. In practice, resistivity is strongly temperature dependent.

```
> S1:=simplify(S);
```

$$S1 := \frac{L2\, A2 - 2\, L1\, A2 + L1\, A1}{A2\, (L2 - L1)}$$

```
> L2:=L1+epsilon*L1;A1:=Pi*r^2;A2:=Pi*(r-mu*epsilon*r)^2;
```

$$L2 := L1 + \varepsilon\, L1$$

$$A1 := \pi\, r^2$$

$$A2 := \pi\, (r - \mu\, \varepsilon\, r)^2$$

There's no loss in generality assuming the conductor, i.e., strain gauge wire, to be cylindrical with initial radius r. Epsilon is strain, of course. Notice the implicit asumption of *tensile* strain, i.e., L2>L1 and A2<A1.

```
> S2:=simplify(S1);
```

$$S2 := \frac{2\, \mu - \mu^2\, \varepsilon + 1 - 2\, \mu\, \varepsilon + \mu^2\, \varepsilon^2}{(-1 + \mu\, \varepsilon)^2}$$

```
> epsilon:=0:S2;
```

$$2\, \mu + 1$$

All terms containing epsilon are << than any devoid of it. Therefore setting epsilon=0 is not an unreasonable approximation. With mu=0.3 (steel) we get S=1.6. Let's set epsilon =0.001 and mu=0.3 and calculate.

```
> epsilon:=0.001:mu:=0.3:S2;
```

1.600270108

(26)GagFac53.mws, 05-03-17. An elementarty treatment of gauge factor.