Cautionary Tale XXXXII Some Quality Aspects of Suspension Springs Ref: 387406

IST's attention was recently drawn to an article in a glossy automotive magazine. It described in detail how to reduce the ride height of your car by 'chopping springs'. This was described as a cheaper route to 'lower' your car than buying specially made 'lowering springs'. Having described exactly how to chop springs, the article then absolved itself of responsibility by saying 'don't do this'. The responsible thing to do would have been to describe the problems with chopping, and not to say how to do this dangerous process.

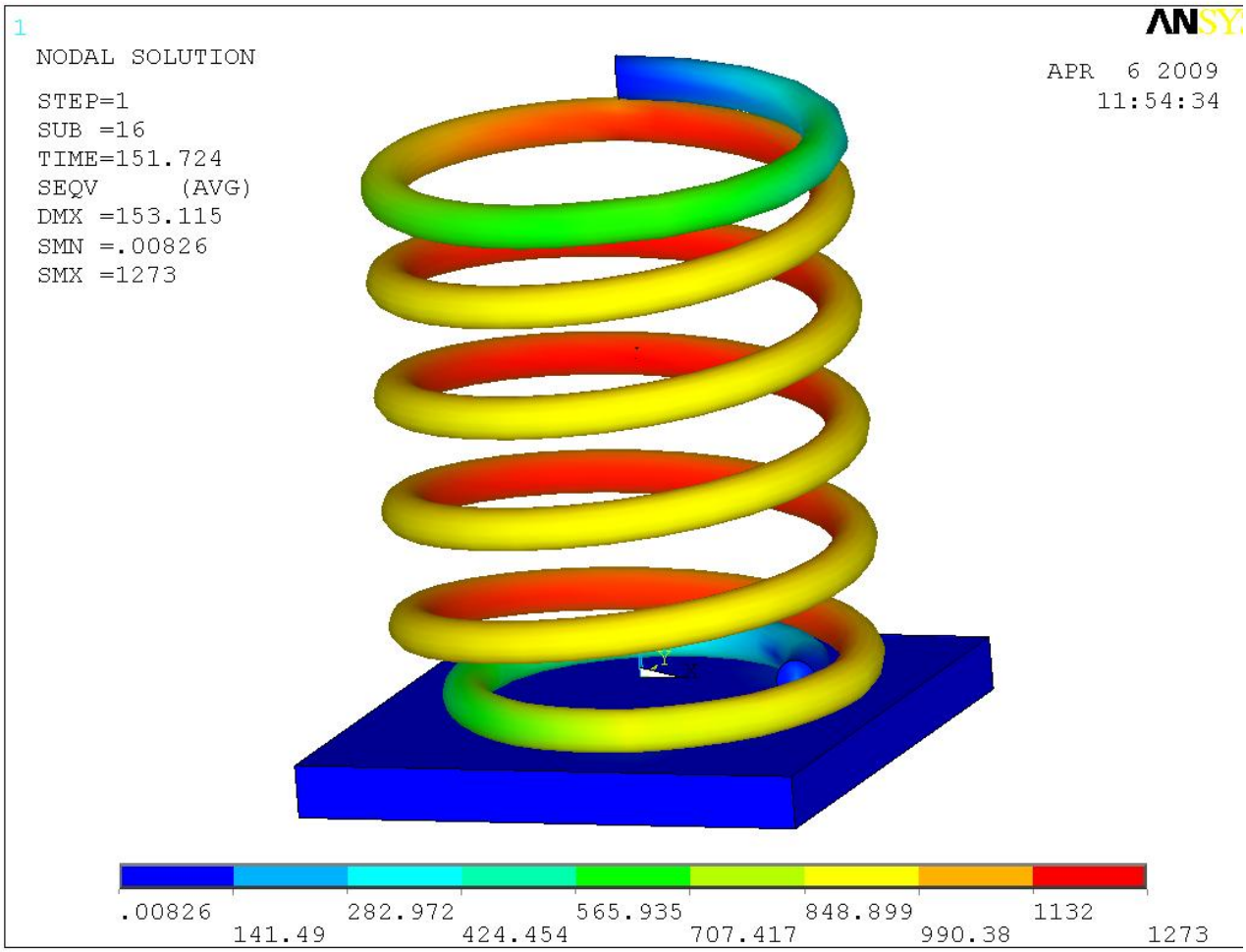
Chopping a coil or two from your car suspension springs will lower the ride height and stiffen the suspension. In theory the car's performance will then be enhanced enabling the driver to take corners at higher speed – don't do this.

If the chopping is not accomplished perfectly symmetrically the handling will self-evidently be detrimentally affected. If done symmetrically, it will usually be necessary to adjust the pitch of the new end coil so that it sits in its end cup accurately and without a permanently built-in stress. This will necessitate stripping the paint from the end coil or whole spring, which is difficult to accomplish – in no case may acid be used. Any change in shape of a coil will require re-stress relieving of the spring – a heat treatment that will ruin the residual stress from shot peening, hence the spring will need to be re-shot peened or will fail due to fatigue. Local shot peening would have to be done very carefully, and then the spring needs to be re-painted. Suspension springs need to be phosphated and powder painted in order to have sufficient corrosion resistance, without this high quality protection, they will fail by stress corrosion cracking.

The first moral of this cautionary tale is 'don't chop springs' – it is much too difficult to accomplish correctly and will almost never be a cheaper, or technically better, option than buying a purpose designed lowering kit.

The second moral of this tale is to say that suspension springs fail in service more often than most other components on a car. That is to say, there are components on a car that are meant to last for the whole life of the vehicle, but suspension springs are less likely to than most. The failure mechanism is often assumed to be fatigue, but this is very seldom the case. In countries where salt is used on the roads in winter, suspension springs fail by a corrosion related mechanism after the paint protection has been penetrated. Corrosion pits can initiate fatigue. Simultaneous corrosion and fatigue can lead to corrosion fatigue. However, by far the most likely mechanism is stress corrosion cracking. The unladen weight of the vehicle is enough to provide this stress, but a few people inside make this failure mechanism more likely. Salt provides the active corrosion. Together they cause stress corrosion cracking usually when the vehicle is parked or moving very slowly – seldom when moving at high speed in IST's experience.

This brings the author to consider the handling of a vehicle. OEM suppliers of suspension springs spend a great deal of time and money optimising not only the axial, but also the non-axial performance of their springs. This is done because most springs have location points to ensure they are correctly oriented relative to the suspension axis, and so they mimic the finite element analysis results, such as that shown in figure 1.



Chopping springs will completely destroy the non-axial characteristics, and may well worsen handling and straight line stability. An additional negative will be the potential for accelerated component wear on suspension components. Don't do it.

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