Reverse engineering the violin

By Professor Jim Woodhouse

The unusual title of this talk encapsulates the essence of a fascinating and stimulating talk given by Professor Woodhouse, an expert in the study of the mechanics of musical instruments at Cambridge University, to the Cirencester Science and Technology Society on 9th April.

In his words reverse engineering is the sort of thing that Samsung might do when they take apart an Apple iPhone to see how it's made. Before getting to grips with the engineering aspects of the violin Jim Woodhouse covered a little history. Emanating from the earlier viol in the mid 15th century the earliest violins can be traced back to the mid 16th century. It seems that the design of these early instruments has in fact changed little over the centuries as exemplified by the famous Stradivarius masterpieces from the 17th century.

Following a brief musical introduction, and using his own violin as the main prop to his lecture, Woodhouse elaborated on three key design objectives for the construction of a violin. These are: the design for sound, the design for strength and design for maintenance.

The historical impetus in designing for sound was the need to increase the volume as music became accessible to larger audiences. This was achieved through reducing the gap between the impedance, or applied force, of the string and the body of the instrument. The lecturer explained that the nearer the values of these two materials the louder the sound produced. One of the problems in attempting to achieve this objective is the difficulty of matching ever weightier strings with ever lighter wooden violin bodies. As it is, the effective force on the bridge of a violin is around 10kg resting on a sculpted layer of wood little more than 3mm thick.

This took the lecturer into the subject of designing for strength and the need for purfling, that is carefully rounding all edges to add strength. He explained that one of the key elements to enhance strength is the need to ensure that all wooden surface areas are curved as such shaping is inherently stronger than a flat surface.

Finally the lecture covered the requirement to design for maintenance, achieved through the choice of glues used to join the main wooden components and overhanging edges that enable the instrument to taken apart if required.

The lecture is available to view online at *www.youtube.com/watch?v=wf_FfC9Uq3U*