ENGN1217 - Assignment 9 due 10 am Friday 23 October 2009

Problem 9.1

Figure 1 below shows drawings of a typical bicycle chain. Consider two components of the chain:
(i) the pin, and (ii) the link.

The chain is under tension caused by a load applied by a person pushing on one of the pedals. Calculate the **maximum** tension in the chain.

Calculate the stresses in the two components, i.e., the pin, and the link. First, derive symbolically the relationship for stresses for the two components.

Next, make numerical calculations and indicate which is the most critical part of the chain in terms of the applied load.

The links and pins are made from the same steel material. The tensile yields strength, σ_y, is denoted k_t. The shear yield strength is denoted k_s. Assume $k_s = \frac{1}{2}k_t$.

Let the safety factor be $SF = 3$. Then we can write for each component,

$$\sigma_{design} = \frac{1}{SF} \cdot \sigma_{fail}. \tag{1}$$

where: σ_{design} is the allowed stress, $\sigma_{fail} = k_t$ for tensile strength, and $\sigma_{fail} = k_s$ for shear strength.

Given data:

- The maximum load applied by a person to the pedal is P_{max}.
- The length of the pedal is L.
- The diameter of the main sprocket is D.
- The diameter of the minor sprocket is d.

The pin is 2.5 mm diameter. The distance between the inner links is 4.6 mm. The link is 5.8 mm at its widest part (where the pin hole is), and 3.5 mm at its narrowest part (between the chain holes). The thickness of the link is 1.2 mm.

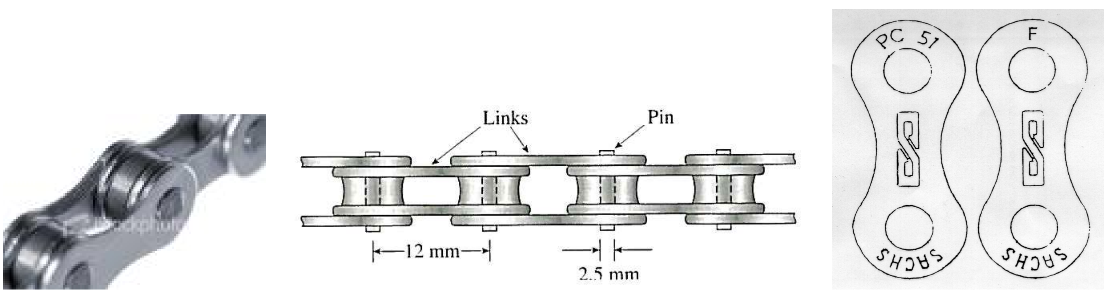

Figure 1: Construction and components of a bicycle chain

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