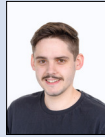


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Subject Area	Product Development
Project Partner	FLINDERS University, Adelaide SA, Australia / Ledgard Pruning Systems, McLaren Vale SA, Australia



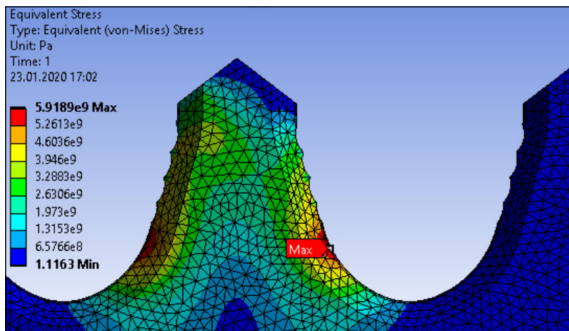
Nico Lipp

## Design of a new pruning cutter bar

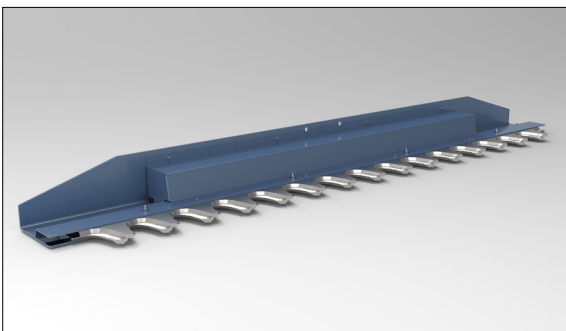
### Redesign and upscale a heavy-duty pruning machine for the Australian orchard market



Current offered Ledgard Pruning medium-duty crank-drive cutter bar on a tractor  
Ledgard Pruning Systems



von-Mises stress analysis - New tooth geometry  
Own presentment



New heavy-duty cutter bar concept  
Own presentment

**Introduction:** To enter the market for heavy-duty pruning equipment for the pruning of orchards, Ledgard Pruning is developing a new heavy-duty cutter bar for the local South Australian market in collaboration with the Flinders University in Adelaide.

The aim of this bachelor's thesis is to develop this new heavy-duty cutter unit. To start, the existing medium-duty crank-drive cutter unit for the pruning of vineyards is analyzed and assessed. With the results of that analysis, a decision can be made whether an optimization or a new design concept can satisfy the customer's requirements for the upscaled cutter unit. The new design shall be elaborated to an advanced prototype, including the mechanical, electric and hydraulic dimensioning, a hazard and risk assessment and a cost estimation.

**Approach:** For the analysis of the current produced cutter unit, an analytical model of the unit is created. This analytical model is programmed in a Matlab-Simulink code. The result of the analysis discloses, that an optimization of the actual crank-drive cutter bar cannot satisfy the requirements for the new heavy-duty cutter bar, because the provided cutting force is too low and the timing of the cutting procedure is suboptimal. Both characteristics cannot be changed and optimized in a proper way. Therefore, a new drive concept is created.

**Result:** The new cutter bar concept consists of two independent driven cutter blades, which perform a contrary movement. This contrary movement, also called scissor cut, provides in combination with the new designed tooth geometry a very clean cutting surface, which can keep the spread of disease as low as possible. Both cutter blades are driven by a separate hydraulic cylinder. Those cylinders can provide a maximum cutting force of 108'000N each, which allows to cut branches with a diameter of up to 60mm. The system can perform a cutting frequency of up to 40 cuts per minute over a long-term period. Each cutter blade has a length of 2500mm and consists of 15 teeth. The cutter unit has a weight of 140kg and can be attached to medium-duty standard tractors with an arm. An attractive selling price can be estimated for this new heavy-duty orchard pruning cutter bar.

The production of the first prototype has already started. With that prototype thorough tests must be performed, especially concerning the teeth design and strength.

In summary, it can be said that Ledgard has received all necessary technical documentation for a successful product development.