

Balsam Labs 2021 End of Year

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1 Projects

This year the lab pursued two projects:

1. A blender that sounds good
2. A robot that cooks for people

The blender was started to provide a source of income for the lab by 2024.

2 The Blender

How do you make a blender which produces a quiet pleasant sound? The blender will require a motor and there are many different types of motors to choose from. Among the existing topologies, we would like to select a motor which makes no noise, however this is not possible. The reason is Maxwell's stress-energy tensor. All magnetic and ferromagnetic materials exhibit a property called magnetostriction, by which their dimensions change under the presence of an applied magnetic field. Atomically, this is caused by magnetic domains in the material behaving as dipoles. If you imagine a dipole idealized as an elliptical bar magnetic, when the magnetic rotates under the presence of an applied field, it acts like a cam and the dimension of the material changes at the boundary. This process is visualized crudely in Figure .

Most motor are constructed from a sheets of silicon steel (steel that has been mixed with trace amounts of silicon) in order to reduce the effects of magnetostriction and other losses such as eddy currenty. The sheets of steel are die cut in the shape of the stator and laminated together with a resin to further reduce eddy current losses. There are two ways to reduce magnetostriction:

1. Discover an improved ferromagnetic alloy which exhibits less magnetostriction
2. Reduce the sound produces by an magentrostriction in an existing material by controlling the magnetic field.

The lab has chosen to persue the second option. By experimenting with different types of motor controllers the current waveform which is applied to the motor has a dramatic effect on the sound the motor produces.