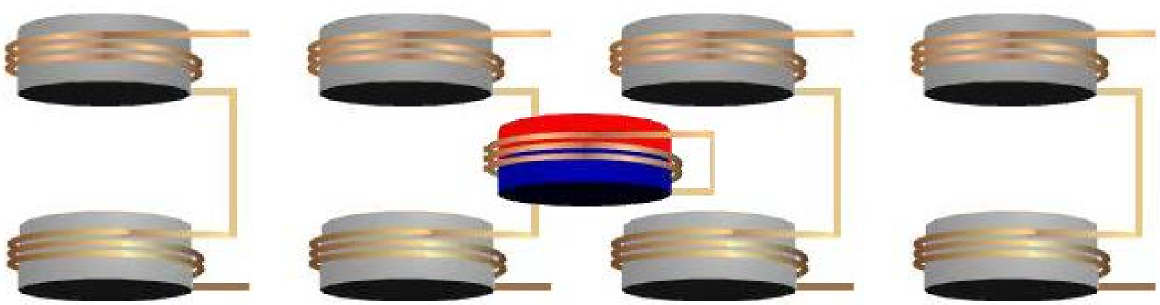
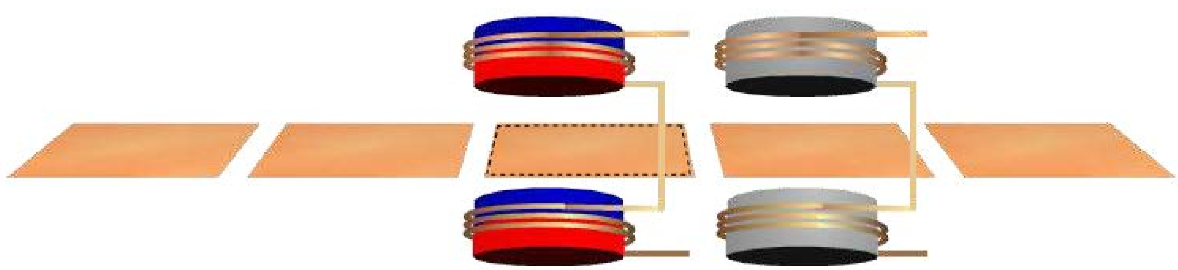
Linear motors

A set of coils can be used to create a magnetic field that translates, rather than rotates. The pair of coils in the animation below are pulsed on, from left to right, so the region of magnetic field moves from left to right. A permanent or electromagnet will tend to follow the field. So would a simple slab of conducting material, because the eddy currents induced in it (not shown) comprise an electromagnet. Alternatively, we could say that, from Faraday's law, an emf in the metal slab is always induced so as to oppose any change in magnetic flux, and the forces on the currents driven by this emf keep the flux in the slab nearly constant. (Eddy currents not shown in this animation.)



Alternatively, we could have sets of powered coils in the moving part, and induce eddy currents in the rail. Either case gives us a linear motor, which would be useful for say maglev trains. (In the animation, the geometry is, as usual on this site, highly idealised, and only one eddy current is shown.)



Some notes about AC and DC motors for high power applications

AC motors are used for high power applications whenever it is possible. Three phase AC induction motors are widely used for high power applications, including heavy industry. However, such motors are unsuitable if multiphase is unavailable, or difficult to deliver. Electric trains are an example: it is easier to build power lines and pantographs if one only needs one active conductor, so this usually carries DC, and many train motors are DC. However, because of the disadvantages of DC for high power, more modern trains convert the DC into AC and then run three phase motors.

Single phase induction motors have problems for applications combining high power and flexible load conditions. The problem lies in producing the rotating field. A capacitor could be used to put the current in one set of coils ahead, but high value, high voltage capacitors are expensive. Shaded poles are used instead, but the torque is small at some angles. If one cannot produce a smoothly rotating field, and if the load 'slips' well behind the field, then the torque falls or even reverses.

Power tools and some appliances use brushed AC motors. Brushes introduce losses (plus arcing and ozone production). The stator polarities are reversed 100 times a second. Even if the core material is chosen to minimise hysteresis losses ('iron losses'), this contributes to inefficiency, and to the possibility of overheating. These motors may be called 'universal' motors because they can operate on DC. This solution is cheap, but crude and inefficient. For relatively low power applications like power tools, the inefficiency is usually not economically important.

If only single phase AC is available, one may rectify the AC and use a DC motor. High current rectifiers used to be expensive, but are becoming less expensive and more widely used.

Source: http://www.animations.physics.unsw.edu.au/jw/electricmotors.html