Introduction to Fluid Couplings

Fluid couplings and torque converters are now commonly used in a wide variety of applications requiring smooth torque transmission, most notably in automobiles. They usually consist of an input shaft that drives a pump impeller which is closely coupled to a turbine impeller that transmits the torque of an output shaft coaxial with the input shaft. The fluid is usually hydraulic oil and the device is normally equipped with a cooling system to dissipate the heat generated. In a typical fluid coupling used, for example, in a ship propulsion system, the pump and turbine are mounted back to back with little separation between the leading and trailing edges of the two impellers. It is common to use simple radial blades and a higher solidity than would be utilized in most conventional pumps or turbines. A torque converter as used in automotive transmission systems has an added set of stator vanes mounted between the turbine discharge and the pump inlet.

A diagram showing the typical components of a torque converter is shown in figure 1. The input drive shaft through which the input power enters the device is connected to the pump impeller (vanes not shown) which drives the oil circulation within the device. That oil flow then drives the turbine which is connected to the output drive shaft through which the powere emerges from the device. Those are the two basic components of a fluid coupling. However, the coupling may have other fluid flow components to improve or change the performance of the device. For example, the device in figure 1 also includes a non-rotating stator whose purpose is to change the inclination of the flow emerging from the turbine so that the incidence angles on the pump vanes improves the hydraulic performance of the device. Another example in the reversible fluid coupling shown in figure 2. When the stator vane in this device is withdrawn the coupling performs like a conventional fluid coupling and the turbine shaft rotates in the same direction as the pump shaft. However insertion of the stator vane reverses the direction of rotation of the turbine shaft. That particular device was designed for the drive train of a ship propellor and thus the stator insertion was designed to reverse the thrust produced by the propellor. The performance of this device is analyzed and discussed in section (????).

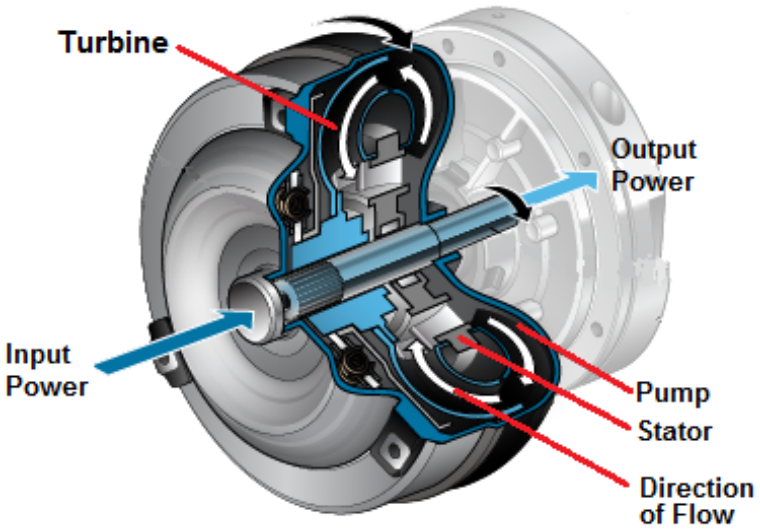

Figure 1: Cutaway diagram of a typical torque converter.

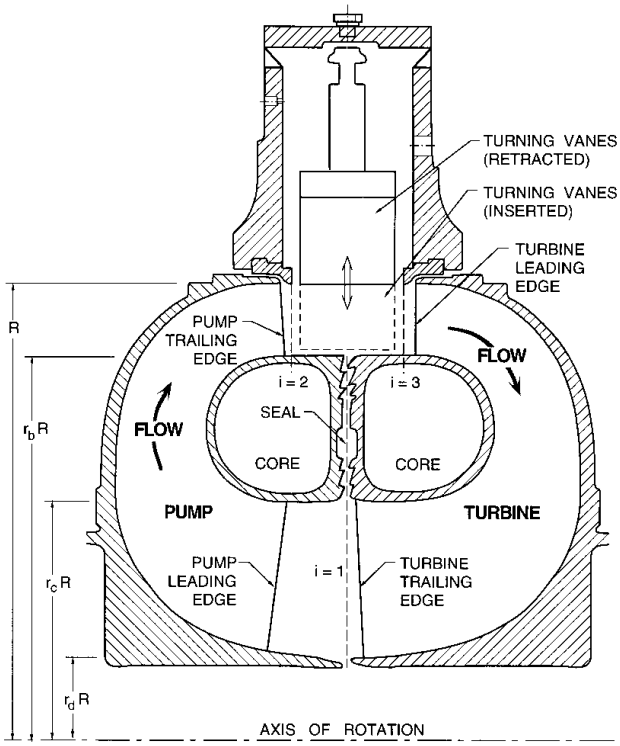

Figure 2: Cross-section of reversible fluid coupling showing key locations in the fluid cavity.