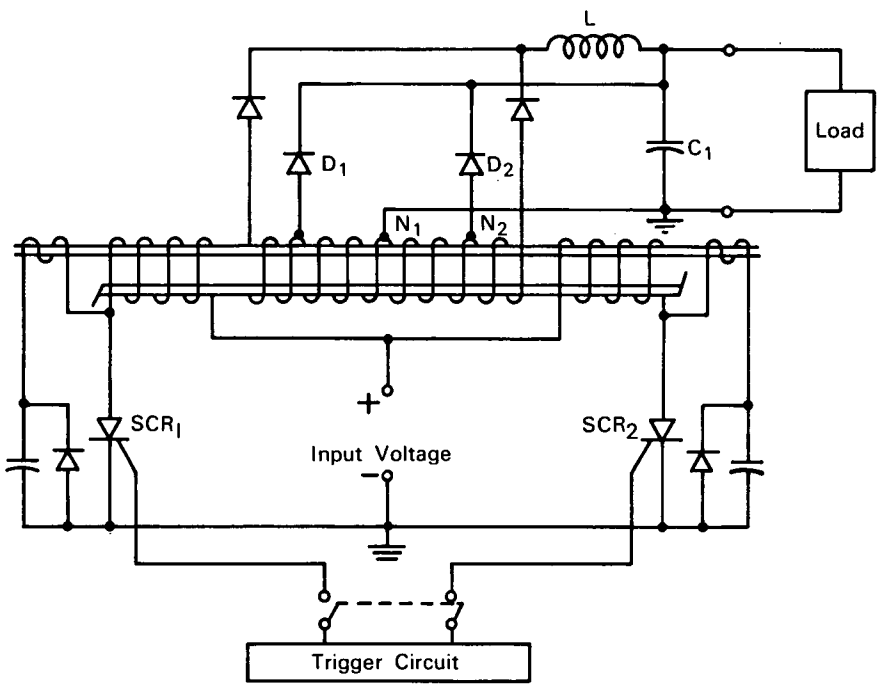
June 1964

Brief 63-10600

NASA TECH BRIEF

Circuit Controls Transients in SCR Inverters



The problem: To eliminate starting difficulties encountered in d-c to d-c converters that employ an SCR (silicon controlled rectifier) d-c to a-c inversion stage with large output-filter capacitances.

The solution: A modified parallel inverter providing a full-wave rectified output that is applied to an L-C (inductive-capacitive) filter.

How it's done: In addition to a center tap, the output winding of the inverter has two other taps. On starting, or under transient loads the two additional taps deliver power through diodes D_1 and D_2 without requiring quenching of SCR currents appreciably in excess of normal starting load current. The converter can be started, when the voltage across the filter capacitor C_1 is initially zero, with the first triggering pulse directed to the gate of SCR_1. When this SCR turns on, a large current will be initiated in the circuit consisting of the winding N_1, diode D_2, and filter capacitor C_1. This capacitor will be quickly charged through D_2 to a lower voltage than that appearing across the combined windings N_1 and N_2. Because of the low transient impedance of this "quick-charge" circuit, it is possible to complete the charging of C_1 so that the current through SCR_1 at the moment of quenching will nearly equal normal load current. As the current in the inductor L increases, the voltage

(continued overleaf)

across C_1 ultimately rises to its steady-state value and consequently renders D_1 and D_2 nonconductive.

Excessive starting current transients through the SCR's are prevented by appropriately positioning the two off-center taps on the inverter, or by inserting small resistors.

Notes:

1. Although the primary purpose of this circuit is to eliminate starting difficulties in SCR inverters, it also eliminates the effects of large transient dips in the load voltage. In this instance, D_1 and D_2 become conductive as the output voltage drops, the reverse voltage across these diodes disappears, and the quick-charge capacitor C_1 tends to offset transients.
2. For further information about this innovation inquiries may be directed to:
   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B63-10600

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: Duke University under contract to Goddard Space Flight Center (GSFC-120)