Long-Range Emergency Preemption of Traffic Lights

Addition of a forwarding system could improve preemption performance.

NASA's Jet Propulsion Laboratory, Pasadena, California

A forwarding system could prove beneficial as an addition to an electronic communication-and-control system that automatically modifies the switching of traffic lights to give priority to emergency vehicles. A system to which the forwarding system could be added could be any of a variety of emergency traffic-signal-preemption systems: these include systems now used in some municipalities as well as advanced developmental systems described in several *NASA Tech Briefs* articles in recent years.

Because of a variety of physical and design limitations, emergency traffic-signal-preemption systems now in use are often limited in range to only one intersection at a time: in a typical system, only the next, closest intersection is preempted for an emergency vehicle. Simulations of gridlock have shown that such systems offer minimal advantages and can even cause additional delays.

In analogy to what happens in fluid dynamics, the forwarding system insures that flow at a given location is sustained by guaranteeing downstream flow along the predicted route (typically a main artery) and intersecting routes (typically, side streets). In simplest terms, the forwarding system starts by taking note of any preemption issued by the preemption system to which it has been added. The forwarding system predicts which other intersections could be encountered by the emergency vehicle downstream of the newly preempted intersection. The system then forwards preemption triggers to those intersections.

Beyond affording a right of way for the emergency vehicle at every intersection that lies ahead along any likely route from the current position of the vehicle, the forwarding system also affords the benefit of clearing congested roads far ahead of the vehicle. In a metropolitan environment with heavy road traffic, forwarding of preemption triggers could greatly enhance the performance of a pre-existing preemption system.

This work was done by Aaron Bachelder of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

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Innovative Technology Assets Management
JPL
Mail Stop 202-233
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-2240
E-mail: iaoffice@jpl.nasa.gov

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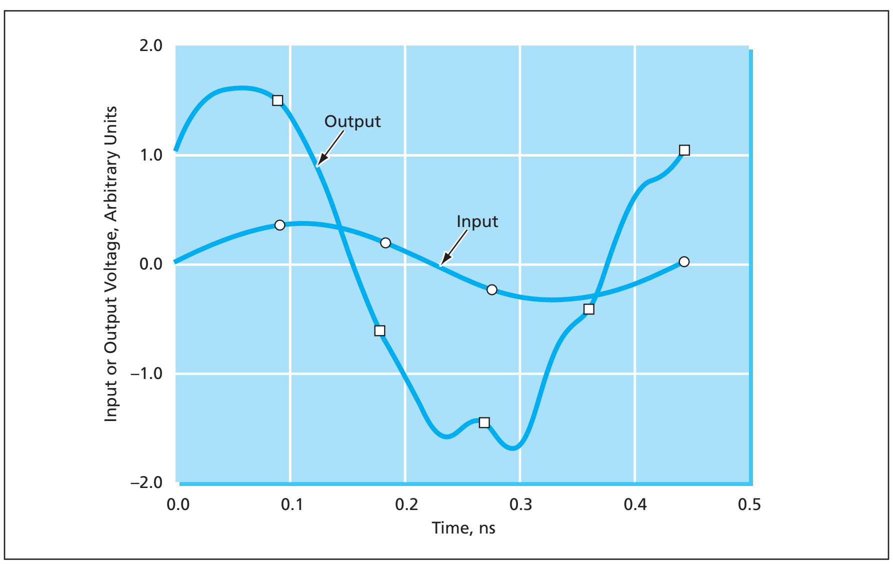
High-Efficiency Microwave Power Amplifier

High efficiency is achieved through class-D operation.

Marshall Space Flight Center, Alabama

A high-efficiency power amplifier that operates in the S band (frequencies of the order of a few gigahertz) utilizes transistors operating under class-D bias and excitation conditions. Class-D operation has been utilized at lower frequencies, but, until now, has not been exploited in the S band.

Nominally, in class D operation, a transistor is switched rapidly between "on" and "off" states so that at any given instant, it sustains either high current or high voltage, but not both at the same time. In the ideal case of zero "on" resistance, infinite "off" resistance, zero inductance and capacitance, and perfect switching, the output signal would be a perfect square wave. Relative to the traditional classes A, B, and C of amplifier operation, class D offers the potential to achieve greater power efficiency. In addition, relative to class-A amplifiers, class-D



The **Output Waveform** of the amplifier is of an intermediate form achieved in an effort to obtain a square-wave output from a sinusoidal input.