value. A larger value of r' will reduce the power dissipated in the load while increasing the reflection coefficient at the input port. It is now possible to obtain the excitation of the radiating waveguide closest to the load and the coefficients of the wave incident and reflected at the input port of this coupling slot. The next coupling slot parameter, r', is chosen to realize the excitation of that radiating waveguide. One continues this process moving towards the source, until all the coupling slot parameters r' and hence the S_{11} parameter of the 4-port coupler, r, are known for each coupling slot. The goal is to produce the desired array aperture distribution in the feed direction. From an interpolation of the computed moment method data for the slot parameters, all the coupling slot tilt angles and lengths are obtained. From the excitations of the radiating waveguides computed from the coupling values, radiating slot parameters may be obtained so as to attain the desired total normalized slot admittances. This process yields the radiating slot parameters, offsets, and lengths. The design is repeated by choosing different values of r' for the last coupling slot until the percentage of power dissipated in the load and the input reflection coefficient values are satisfactory.

Numerical results computed for the radiation pattern, the tilt angles and lengths of coupling slots, and excitation phases of the radiating waveguides, are presented for an array with uniform amplitude excitation. The design process has been validated using computer simulations. This design procedure is valid for non-uniform amplitude excitations as well.

Time Manager Software for a Flight Processor

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Data analysis is a process of inspecting, cleaning, transforming, and modeling data to highlight useful information and suggest conclusions. Accurate timestamps and a timeline of vehicle events are needed to analyze flight data. When data is gathered onboard a rocket, precise time stamping is even more important due to the rocket's high speeds and the requirement to integrate data over time for inertial navigation calculations.

Accurately time-tagging data currently requires an additional accurate timecode generator board. This solution is costly but is usually adequate for ground-based systems. However, this solution is not adequate for flight processors on rockets. Rocket systems require more costly ruggedized equipment where weight, size, and power constraints are an issue. Redundancy is also required, adding even more to the system's weight, size, and power consumption.

By moving the timekeeping to the flight processor, there is no longer a need for a redundant time source. If each flight processor is initially synchronized to GPS, they can freewheel and maintain a fairly accurate time throughout the flight with no additional GPS time messages received. However, additional GPS time messages will ensure an even greater accuracy.

Some modern microprocessors maintain a 64-bit internal time-base register that is incremented by a crystal oscillator, usually with a 20- to 100-MHz frequency. This time-base register can be read in an interrupt service routine (ISR) generated by the 1 pps signal from the GPS receiver. Next, a GPS time message is received. The time-base count is associated with the GPS time message time.

When a timestamp is required, a get-time function is called that immediately reads the time-base register. A delta count is calculated from the last GPS sync. The current time is calculated by adding this delta time to the last sync time. This process calculates a timestamp with an accuracy measured in microseconds, depending on the processor clock speed and the accuracy of the processor clock. If a 1 pps GPS ISR is not available, the time base register can be synchronized with the receipt of the GPS time message. If the microprocessor does not have a 64-bit internal time-base register, a countdown timer can be used.

Simulation of Oxygen Disintegration and Mixing With Hydrogen or Helium at Supercritical Pressure

These models can be used in simulations of gas turbine engines.

NASA's Jet Propulsion Laboratory, Pasadena, California

The simulation of high-pressure turbulent flows, where the pressure, p, is larger than the critical value, p_c, for the species under consideration, is relevant to a wide array of propulsion systems, e.g. gas turbine, diesel, and liquid rocket engines. Most turbulence models, however, have been developed for atmospheric-p turbulent flows. The difference between atmospheric-p and supercritical-p turbulence is that, in the former situation, the coupling between dynamics and thermodynamics is moderate to negligible, but for the latter it is very significant, and can dominate the flow characteristics. The reason for this stems from the mathematical form of the equation of state (EOS), which is the