HIGH-Q SINGLE-CRYSTALLINE RESONATOR FABRICATION OF CRG-1 FOR INCLINOMETRY OF OIL & GAS DRILLING AND LONG-TERM SATELLITE MISSION

Description
A new unique design & tech of a shell gyroscopic resonator for solid-state wave inertial sensor CRG-1 has been grown from high-purity single-crystalline sapphire together with supporting flange with no mechanical machining. The proposed single-piece single-crystalline structure has a cost reduced in order of value in respect to well-know HRG130 resonator, and let us develop a range of sensors with different diameters to meet customer’s specs. Such tailored designs use the material, which with Q-factor in 10 times higher then fused quartz. The latter let us increase grade of the sensor or to obtain the inertial grade of this angular rate sensor by simpler surface processing (etching, magnetron filming). New generation have a thick flange (never fabricated earlier by any other company) and a special elastic decoupling of sensing and fixture elements of the part.

Innovative Aspect and Main Advantages:
HRG is the best US sensor for NASA space missions and oil industry (Northrop Grumman Corp., earlier – Litton Guidance & Control Systems), and has its French analog (Sagem Defense Securite). Both sensors made from high-purity quartz glass (fused quartz), which has Q-factor smaller in order of value in respect to proposed sapphire design. HRGs are fabricated by mechanical machining from a block of glass, and their production required expensive specialists and tools. The STM labor-saving tech let us develop a competitive product for these specific markets. We have experience of 2 contract on HRG development with Litton G&CS, and of several other international projects.

Areas of Application:
Oil& gas industry (inclinometry of wells and drilling); Satellites (stabilization and navigation for long-term space missions).

Stage of Development:
Two generations of sapphire resonators have been successfully fabricated, the samples have been tested also by an independent laboratory (Lomonosov’s Moscow State University). The complete design of the device has been developed basing on experience of HRG development in past years.
So, on technology and material level, – it is ready for market and supported by operating facilities; on resonator level, – it is available for demonstration; on electromechanical block level, – it is designed and will be available for demonstration in 2008; on instrument level, – it can be developed in a variant tailored to customer’s specs, basing on our previous HRG designs, including control loops & electronics.

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