Stereoscopic Machine-Vision System Using Projected Circles

This system identifies obstacles in relatively short processing times.

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A machine-vision system capable of detecting obstacles large enough to damage or trap a robotic vehicle is undergoing development. The system includes (1) a pattern generator that projects concentric circles of laser light forward onto the terrain, (2) a stereoscopic pair of cameras that are aimed forward to acquire images of the circles, (3) a frame grabber and digitizer for acquiring image data from the cameras, and (4) a single-board computer that processes the data. The system is being developed as a prototype of machine-vision systems to enable robotic vehicles (“rovers”) on remote planets to avoid craters, large rocks, and other terrain features that could capture or damage the vehicles. Potential terrestrial applications include terrain mapping, collision avoidance, navigation of robotic vehicles, mining, and robotic rescue.

This system is based partly on the same principles as those of a prior stereoscopic machine-vision system in which the cameras acquire images of a single stripe of laser light that is swept forward across the terrain. However, this system is designed to afford improvements over some of the undesirable features of the prior system, including the need for a pan-and-tilt mechanism to aim the laser to generate the swept stripe, ambiguities in interpretation of the single-stripe image, the time needed to sweep the stripe across the terrain and process the data from many images acquired during that time, and difficulty of calibration because of the narrowness of the stripe.

In this system, the pattern generator does not contain any moving parts and need not be mounted on a pan-and-tilt...