Reaction Report IX:
Dual-Shutter Optical Vibration Sensing

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April 8, 2023

Identify one idea in the paper that you feel is a major contribution or a major limitation, explain it, and discuss why it is important

This research demonstrated many novel ideas for visual vibrometry, for me its biggest contribution is the using of a speckle pattern to capture the virabtion from multiple sources without the needs of a high speed camera. The intuition behind this idea is to first use laser to point to a diffuse object and capture speckle pattern to get a virtual image plane which will be passed through relay optics before being projected to a dual shutter system. While the rolling shutter (create image sequentially by scanning scene multiple times) can capture the unknown shifts at each row given its frequency, the global shutter (create image by taking single snapshot) tracks the undisturbed speckle pattern and provides references to recover the unknown 2D shifts in each row of rolling shutter image. One noticeable point is the method can effectively measure the displacement even with large shift of object both vertically and horizontally using multi reference frames. I think this idea of using dual shutter system is important since it remove the needs of high speed camera in vibrometry which is a cost barrier in this field of research.

Describe one idea of yours that builds on the paper and expand on that idea as much as possible

Even that the experiment setting is not trivial with lots of variables, I wonder how it would work in a more complex scenario such as outdoor environment with various light and ambient sound conditions. I guess retro-reflective markers couldn't help much in that case, I think may be it is possible to use multiple laser light sources from different views to calibrate the final pattern. Another question is if we know about the characteristics of the material (BRDF, elasticity, shape), will the system work better? For example an metal ball with specular surface will produce less vibration and more reflection than a dark glossy plastic cube. If we can somehow capture the difference, I think it will be a potential source to imporve the current system. Perhaps it is possible to simulate these data to verify this question, but I assume the environment should not be complex.