

AutoGrid In-Process Facility

AutoGrid[®] facilitates the measurement of forming limit curves (FLC's)

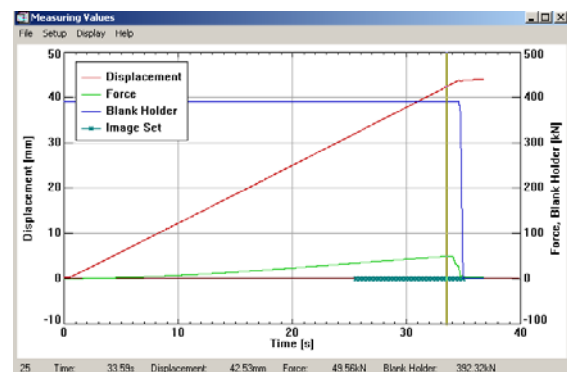


After years of dedicated development and comprehensive testing, ViALUX has introduced the AutoGrid[®] automatic strain analysis system specifically designed along the needs of sheet metal industry in 1999. Based upon grid patterns that consist of electrochemically-marked orthogonal lines spaced at 1 to 5 mm, the system is able to determine a field of strain values on specimens or components. Strains are in the range of 0.5% to more than 100% without any unambiguity. A two-step approach of videogrammetry is combined with a compact design of the measuring head providing ease of use, full mobility as well as fast and reliable operation also in the harsh environment of forming industry. The system proved well suited for a variety of applications in deep drawing and hydroforming as well as for different materials including aluminium alloys, stainless steel and fibre reinforced composites.

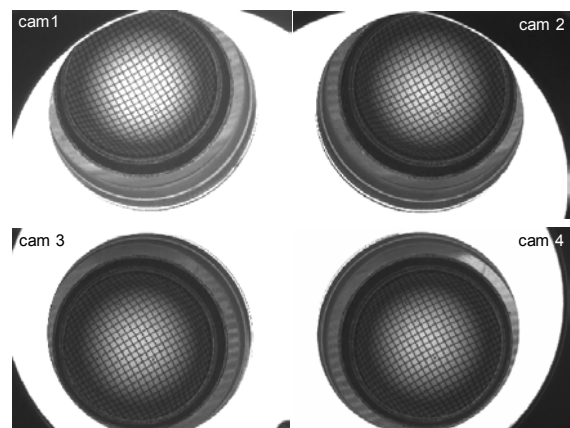
The innovative AutoGrid[®] solution uses four CCD cameras that are mounted on the measuring head. The cameras can be adjusted conveniently and the arrangement is easily and reliably calibrated by means of a calibration gauge before a series of measurements takes place. The pre-calibrated measuring head can be moved around and is immediately ready for measuring the 3D grid shape and distortion, respectively. It is important to note, that the images of all four cameras can be recorded simultaneously enabling the analysis of dynamic processes as well. This has been implemented in

the *in-process option* and led to a significant advantage of the AutoGrid[®] solution: the same equipment and software can be applied to determine the formability in a testing machine and to analyse the actual strains of sheet metal parts in the die tryout process or during problem solving.

ViALUX presented this extension for AutoGrid[®] on the EUROBLECH 2000 fair in Hannover for the first time. The system has been demonstrated to operate with an ERICHSEN testing machine. All four cameras observing the specimen from different perspective views are exactly synchronized and the image sequences are recorded with a rate of up to 30 x 4 frames per second. Electronic shuttering is combined with the progressive scanning mode of the cameras to avoid any blur or disturbance due to the object motion. In addition, the corresponding data of the testing machine (force, path) are also recorded and related to the image sequence. In case of the testing velocity of 1-2 mm/sec, a punch depth resolution of less than 0.05 mm can be achieved. Recording can be started automatically by thresholds in time, machine force or punch displacement, respectively.

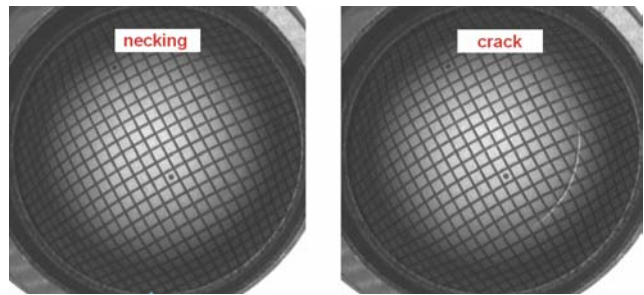


After the test, the whole sequence of image ensembles is stored in memory and may be inspected immediately or saved to disk for further analyses if desired. The sequence can be displayed step by step, zoomed and also connected to force/path data in order to identify the moment and the location where the critical necking occurred first.

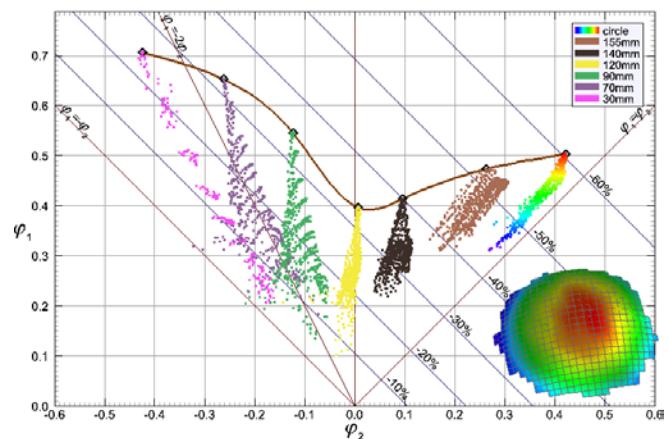


The results of a specimen for the forming limit diagram are available about 3 min after the test run. A variety of stress conditions is required for a complete forming limit curve. They are generated by differently shaped specimens and, using *AutoGrid*[®], all the results can be conveniently combined in one diagram to define the points of a FLC interactively.

ViALUX provides a fast and accurate tool for the determination of forming limit curves (FLC's) of sheet metal materials. Directly connected to the testing machine, the systems gives precise access to the maximum strain value just *before* necking and subsequent cracking occurs. Comfortable software allows to create FLC's from a set of specimens very effectively. The in-process ability of *AutoGrid*[®] can of course also be used e.g. for bulge or tensile tests.



Forming Limit Diagram



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Specifications

- Computer:** additional PCI frame grabber for simultaneous and synchronized image capture from 4 progressive scanning CCD cameras
 A/D converter card for reading analogous machine data (force, punch displacement)
 RAM extension for long video sequences (> 300 image ensembles)
- Measuring head:** special camera support adapted to testing machine
 optional 4 additional cameras and imaging lenses
- Recording:** maximum frame rate: 120 frames = 30 image ensembles of 4 pictures per second
 start of digital video recording automatically controled by machine data
- Lighting:** removable LED illumination set optimized for the testing machine
- Calibration:** calibration body with adapted size
 verification facility for pre-checking before test run
- Software:** user-friendly in-process recording control
 replay facility for video sequences saved in RAM or disk storage
 step by step operation and image zoom function
 combined display of acquired measuring values (e.g. force, punch displacement) with picture sequence
 comfortable module for generating FLC's interactively by loading all measurements from the FLC test