SPECIAL SOLUTION BRINGS SHIFT FORKS TO MEASURE

SENSOR-BASED SYSTEM PROVES ITSELF IN USE

BEAS Technology GmbH developed a special system for the measurement of car gearshift forks, which are straightened with the same solution in case of deviations from the tolerances. Laser sensors from ipf electronic form the basis for always precise and reproducible measurement results.

''We developed the system about a year ago on behalf of an OEM in the automotive sector for a plant in Delhi (India). Therefore, it is designed as a manual workstation,'' explains Holger Fischer, Head of Business Development at BEAS Technology. The company based in Chemnitz, Germany, plans, develops, realizes and optimizes fixtures as well as special machines, e.g. solutions for the field of 3D printing, test benches, welding fixtures as well as assembly systems for drilling, deburring and joining gearbox components (including shift forks). With its in-house robotics studio, BEAS Technology also specializes in the simulation, development and commissioning of robot applications as well as programming. The company's solutions and core competencies are complemented by an extensive AZAV-certified training and education offering as well as various consulting services.

NOT ALWAYS WITHIN THE TOLERANCES

The production of shift forks takes place in several manufacturing steps. After fine blanking and bending of the sheet metal parts, the forks are usually welded. As a result, the dimensions of the shift forks are not always within the desired tolerances. ''We close this ''gap'' between the accuracy of the welded part and the required delivery quality with our system, which we use to measure the shift forks and straighten them if there are deviations,'' says Fischer. To achieve the required drawing tolerances, the distances of each fork arm to the shift fork center are relevant first. In addition, the fork ends, which are often slightly twisted in themselves, must be at the same height or on the same level. Therefore, the system should additionally measure the so-called interlacing at the fork ends.

MEASUREMENT ERRORS AND NON-REPRODUCIBLE MEASURED VALUE DETERMINATION

As a solution, BEAS Technology initially preferred a tactile sensor system.
Holger Fischer comments: ''However, problems were caused by the fork ends or fork flats that were overmolded with plastic and thus cambered, which meant that they did not have a smooth surface for correct probing. Due to the slight torsion, it is not always possible to hit the exact center when probing a fork flat, which inevitably led to measurement errors and made it impossible to reproduce the measured value determination.'' For this reason, the direct measurement approach was rejected. ''Instead, we realized that the only optimal method for developing our system was by indirect measurement.''

WITH DIFFERENTIAL MEASUREMENT TO THE DESIRED RESULT

For this purpose, two specially shaped metal arms are located above the ends of the shift fork to be measured. These arms are moved by pneumatic cylinders until they touch the fork ends at the inner measurement points. Two optical sensors then detect the deflection of the two outer ends of the metal arms. ''Via the analog outputs of the sensors, we receive distance-proportional signals separately for each fork side, which we use for differential measurements. The indirect measurements thus enable us to determine the deviations from the desired optimum both for the distances of the two fork ends from the center of the shift fork and for their heights relative to each other,'' explains Fischer.

HIGH-PRECISION SOLUTION EVEN FOR HARSH CONDITIONS

The two optical sensors therefore had to be high-precision solutions and, moreover, withstand harsh environmental conditions, since, according to Holger Fischer, ''extremely robust operating conditions'' were to be expected for the system. BEAS Technology therefore decided to use laser sensors of the **PT44** series from ipf electronic.

These sensors with background suppression and a very small diameter laser beam have a sturdy die-cast aluminum housing (degree of protection IP67) and are designed for operating temperatures from -10°C to +45°C. The devices with a maximum range of up to 35mm integrate a switching output with window function and an analog output (0...5V/4...20mA).

ACCURACIES IN THE HUNDREDTHS RANGE

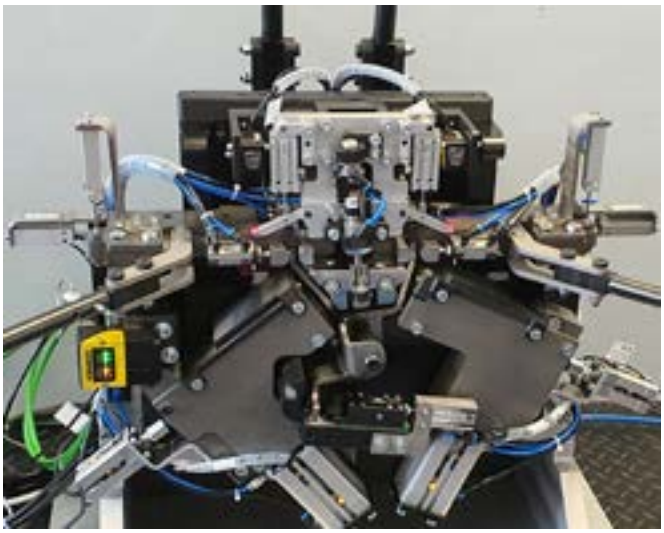
The parameterization of the sensors for the described application was carried out using a reference part. For this purpose, a shift fork was straightened with a view to optimum dimensional accuracy and then measured in a 3D measuring machine in order to use it as a calibration piece for the sensors installed in the BEAS Technology system. ''Calibration of the sensors was completely unproblematic, with the initial value for each measurement always being 0. We then obtain the respective deviations via the differential measurements, whereby the accuracy here lies in the range between 0.01mm and 0.02mm. The smooth surfaces at the ends of the metal arms, in combination with the precise, point-like laser light of the sensors, enable us to make very precise and, above all, always reproducible measurements,'' emphasizes Fischer.

EXTREMELY SIMPLE AND INTUITIVE OPERATION

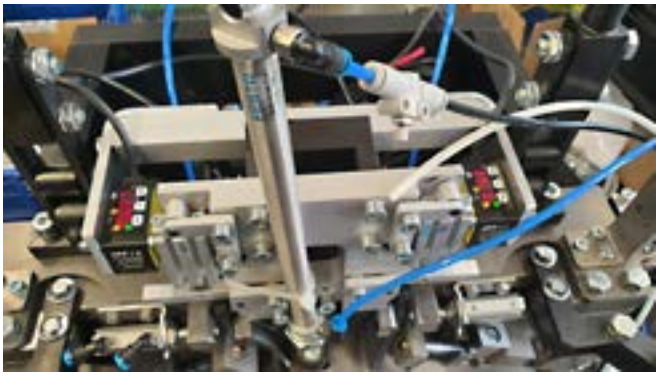
If the measured values move outside the tolerances, the operator can adjust the shift fork accordingly, using various straightening operations. ''To do this, we deliberately chose a lever that he has to move for each operation to avoid operating errors in the system,'' says Fischer. The operator is also guided or instructed by software that visualizes the deviations from the tolerances on a workstation screen and shows him at which position the fork has to be aligned in each case.

POSITIVE FEEDBACK ON INSTALLED SYSTEMS

Two systems from BEAS Technology have now been in use in India for several months and Holger Fischer has already received positive feedback: ''We have received confirmation from the Delhi plant management that our system, and thus the sensors, function perfectly even under the harsh and robust operating conditions. Due to the consistently good experience, we have now received the order to roll out the system further.''



This special solution was developed by BEAS Technology for measuring and straightening shift forks. A central component is the area with the two sensors from ipf electronic for the measurements.
(All pictures: BEAS Technology GmbH)



The two **PT440300** laser sensors are installed above the metal arms that can be moved via pneumatic cylinders. The two laser dots on the ends of the metal arms can also be seen.

The analog outputs of the sensors provide a distance-proportional signal separately for each shift fork side, which is used for differential measurements.

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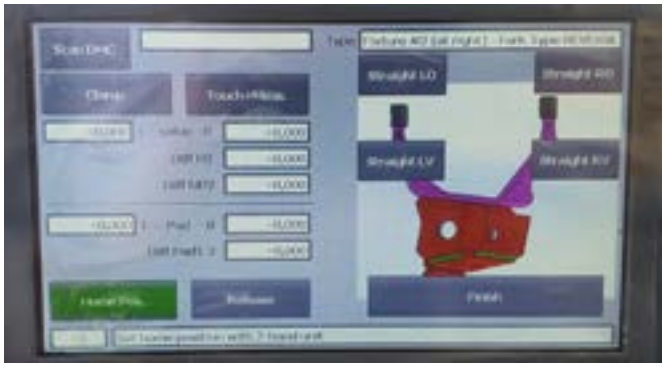
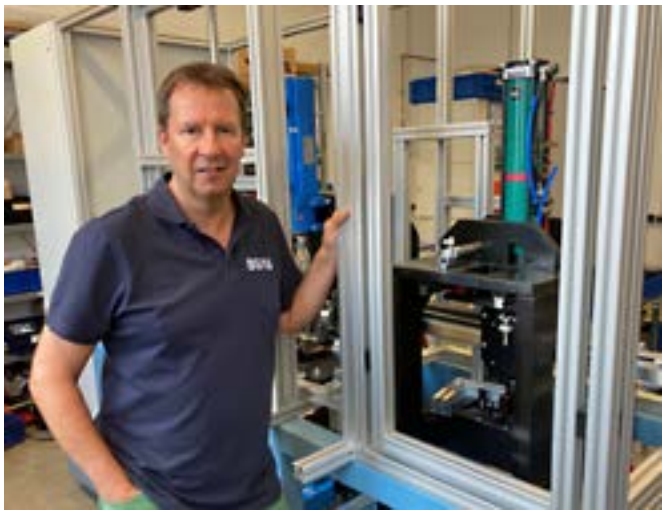


The worker in the Delhi plant is guided or instructed via software. It visualizes not only the deviations, but also the respective positions of the reversible lever for the individual straightening operations..



Holger Fischer, Head of Business Development at BEAS Technology: ''We have received feedback from the Indian plant that our system with the sensors works perfectly even under harsh operating conditions.''