Chapter V

Conclusions and Recommendations

Casing is used to stabilize the sides of the well, to prevent pollution of fresh water reservoirs, and to prevent fluids from zones other than producing zones from entering the well. If the casing is damaged, it may not be able to withstand the burst or collapse pressure. If the casing wall is precipitated by scale, this precipitation obstructs the flow of reservoir fluid to the surface in case of monobore completion. To detect casing damage and scale precipitation, casing inspection must be made by measuring the radii of casing. Then, an algorithm is used to process the data.

The currently used algorithm, the vector sum, is based on the assumption that the casing is round. As the tool may not be at the center of the casing, the measurements are eccentric. The vector sum algorithm eliminates this eccentricity by finding a correcting vector that shifts all the vectors of radius measurements to the center of the casing. Then, the radii are corrected using this correcting vector.

The proposed method is the ellipse fit algorithm which fits the data by an ellipse. Since this method utilizes the least squares fitting of ellipse, it can be used when the casing shape is circular or oval. The ellipse fit processes the data to calculate the coefficients of ellipse and the ellipticity.

In order to see a casing damage or scale precipitation, one run of the measurements is need. In the vector sum algorithm, the differences between the corrected radii and the average radius are compared at all depths. In the ellipse fit algorithm, the difference between the raw radii and the ellipse curve are compared at all depths. The damage or scale precipitation can be visualized easily when these differences are plotted up using color map.

In order to see changing condition of the casing, two measurement runs must be made and synchronized. There are two kinds of synchronization. In the first type, a deviation sensor is used in both runs to determine the tool orientation and synchronize the measurements. In this case, both the vector sum and ellipse fit algorithms can be used to process the data. In the second type, we attempt to eliminate the use of the deviation sensor in the second run. In this thesis, the ellipse fit algorithm was chosen to process the data. The caliper tool, run into wellbore to measure the radii at different times, may start its measurements at the different positions. Thus, we need to synchronize the data between two runs by comparing the fits obtained from the ellipse fit algorithm.

The assumptions that were used in this study are as follows:

1. The tool may not be at the center of the casing.
2. The casing has a circular or oval shape.
3. The overall casing shape does not change between two runs. Therefore, we can synchronize measurements between two runs to see the development of damage and scale precipitation.

From this study, the following conclusions can be drawn:

1. The vector sum algorithm can process the data only when the casing shape is circular but the ellipse fit can process the data when the casing shape is both circular and oval. With the new algorithm (the least squares fitting of ellipses), the casing damage can be detected very easily while the currently used algorithm (vector sum) has a problem when the casing shape is oval.
2. The vector sum algorithm has some drawback when some of the data are missing. However, this problem can be overcome when the missing data is replaced with the internal radius of the casing otherwise the ellipse fit algorithm is used.
3. The ellipse fit algorithm can be used in any case while the vector sum algorithm has certain limitations.
4. Since the data used in this study are limited, the section on synchronization between two runs needs further investigation before a more concrete conclusion can be drawn.