**Baraa M. Arab**

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|  | **Source/Evidence/ Data #1** | **Source #2** | **Source #3** | **Source #4** | **Source #5** |
| **Citation** | Bickerstaffe, S. (2011, November 1). Change Strategy. *Automotive Engineer*, 20-21. | Honeywill, T. (2007, June 1). Shifting dual clutches. *Automotive Engineer*, 19-19. | Paul, W., & Nong, Z. (2012). Investigation of synchroniser engagement in dual clutch transmission equiped powertrains. *Journal of Sound and Vibration,* *331*, 1398-1412. | Van Berkel, K., Hoffman, T., Serrarens, A., & Steinbuch, M. (2013). Fast and smooth cluthc engagement control for dual-clutch transmissions. *Control Engineering Practice,* *22*, 57-68. |  |
| **Purpose** | To discuss how the dual clutch transmission optimizes shifting experiences and is being generalized to more high performance cars. | This article discusses how dual clutch transmission systems are preparing to enter the mass market in Europe and ultimately in the United States. | To study the impact of vibrations on the function and efficiency of the dual clutch transmission system. | To report the results of an attempt to use a simple controller to introduce clutch engagement phases with a dual-clutch transmission, making it easier to use and more efficient. |  |
| **Why is the study necessary?** | It is necessary because it allows for the exploration of the use of dual clutch transmissions in more vehicles and provides some speculation on the next advancements that will be made in transmission technology. | This study is necessary because, until recently, dual clutch transition systems have been relegated to the high end high performance market and have not been affordable to the general consumer. | This study was necessary to see if vibrations would impact the function of the dual transmission system, and is important for understanding the long term use of a dual transmission system as they are made available to a greater market and used on cars that may have more vibration. | Dual clutch transmissions remain difficult to apply to a large number of cars. Having a method of phasing in clutch engagement would make them more practical, tracking the torque demand and creating clutch engagement that is both fast and smooth. |  |
| **Methods** | The author drove a MacLearen with a dual shift transmission and with pre-cog technology. | The author interviewed makers of dual clutch transmission systems and distributors, as well as relying on his own previous expertise. | Mathematical models and functions were used to measure the vibration and to apply that to increasingly complicated situations. | They ran experiments that relied on a simple controller to phase in clutch engagement and compared the ability of the clutch to track torque and engage smoothly both with and without the controller. |  |
| **Results** | The shifting was incredibly smooth and the driving experience was improved. | The article concluded that the technology is ready for the mass market in Europe and that the desire for higher fuel efficiency has made the market in the U.S. ripe for the introduction of the dual clutch transmissions to the average consumer. | This study found that a large amount of vibration was likely to wear on the synchronizer mechanism and create damaging wear when applying a dual transmission system to conventional engines. | The simple controller did its job well, and made the dual-clutch transmission smoother and “smarter,” resulting in a better ride and easier use. |  |
| **Discussion/Conclusion** | The author concluded that this technology will be available in more high performance cars and will continue to be improved upon. He also concluded that for the short term, it is too expensive to be readily available to the average consumer. | Within the next few years, lighter weight and mid-sized vehicles marketed at the average consumer will begin moving to dual clutch transmissions as a way of improving fuel efficiency and the driving experience. | In order to use a dual clutch system with traditional engines, steps will need to be taken to make sure that vibrations from traditional engines are minimized. | The paper ultimately concluded that a controller would be a good addition to a dual clutch transmission and better allow it to be a smooth ride and more efficient. |  |
| **How can this help my senior project?** |  |  |  |  |  |