Modeling of plates with multiple anisotropic layers and residual stress - DTU Orbit (08/11/2017)

Modeling of plates with multiple anisotropic layers and residual stress

Usually the analytical approach for modeling of plates uses the single layer plate equation to obtain the deflection and does not take anisotropy and residual stress into account. Based on the stress–strain relation of each layer and balancing stress resultants and bending moments, a general multilayered anisotropic plate equation is developed for plates with an arbitrary number of layers. The exact deflection profile is calculated for a circular clamped plate of anisotropic materials with residual bi-axial stress.From the deflection shape the critical stress for buckling is calculated and by using the Rayleigh–Ritzmethod the natural frequency is estimated. Using the Galerkin method, an approximate deflection shape is calculated for a rectangular plate, and for a square plate the expression can be simplified drastically. To support the results, the model has been compared to a FEM model, and an excellent agreement between the two models is seen with a relative difference of less than 2% for all calculations. The model was also used to extract the cell capacitance, the parasitic capacitance and the residual stress of a pressure sensor composed of a multilayered plate of silicon and silicon oxide. The extracted values were in good agreement with the expected and it showed that the behavior of devices with a plate could easily be predicted with a low uncertainty.

General information

State: Published
Organisations: Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Silicon Microtechnology
Authors: Engholm, M. (Intern), Pedersen, T. (Intern), Thomsen, E. V. (Intern)
Number of pages: 10
Pages: 70-79
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: Sensors and Actuators A: Physical
Volume: 240
ISSN (Print): 0924-4247
Ratings:

BFI (2017): BFI-level 2

Web of Science (2017): Indexed Yes

BFI (2016): BFI-level 2

Scopus rating (2016): CiteScore 2.79 SJR 0.803 SNIP 1.655

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 2

Scopus rating (2015): SJR 0.848 SNIP 1.599 CiteScore 2.73

BFI (2014): BFI-level 2

Scopus rating (2014): SJR 0.878 SNIP 1.798 CiteScore 2.41

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 2

Scopus rating (2013): SJR 0.827 SNIP 1.802 CiteScore 2.53

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 2

Scopus rating (2012): SJR 0.915 SNIP 2.113 CiteScore 2.34

ISI indexed (2012): ISI indexed yes

Web of Science (2012): Indexed yes

BFI (2011): BFI-level 1

Scopus rating (2011): SJR 0.907 SNIP 2.111 CiteScore 2.5

ISI indexed (2011): ISI indexed yes

Web of Science (2011): Indexed yes

BFI (2010): BFI-level 1

Scopus rating (2010): SJR 1.106 SNIP 1.834

Web of Science (2010): Indexed yes

BFI (2009): BFI-level 1

Scopus rating (2009): SJR 1.029 SNIP 1.674

Web of Science (2009): Indexed yes

BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.973 SNIP 1.612
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.944 SNIP 1.42
Scopus rating (2006): SJR 0.913 SNIP 1.636
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.955 SNIP 1.736
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.964 SNIP 1.727
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.149 SNIP 1.484
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.055 SNIP 1.458
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.946 SNIP 1.458
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.789 SNIP 1.251
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.578 SNIP 0.875
Original language: English
Anisotropic plate theory, Micromechanics, Stress, Multilayers
DOIs:
10.1016/j.sna.2016.01.054
Source: FindIt
Source-ID: 2291754282
Publication: Research - peer-review › Journal article – Annual report year: 2016