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<th>Title</th>
<th>Investigation of the effect of dead space on frequency response of Avalanche Photodiodes</th>
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<tr>
<td>Author(s)</td>
<td>Heng, Jillian Swee Teng</td>
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Background and Motivation:
Avalanche Photodiodes are optoelectrical devices with an internal gain provided by avalanche multiplication. As excess noise is inherent with the multiplication process, it restricts the applications of APDs.

The dead space effect has been exploited to reduce excess noise and raise device performance. However, the introduction of dead space has effects on the speed response of APDs and these have to be considered before applications.

Aim:
Investigate the effect of:
• Dead space, d, on frequency response
• Ionization threshold energy, $E_{th}$, of carriers on cutoff frequency, $f_0$
• Ratio $k = \alpha^* / \beta^*$ on response

$f_0$ is defined to be the frequency where response has dropped by 3dB
$\alpha^*, \beta^*$ are effective ionization coefficient of electrons and holes respectively

Methodology:

Results:

Conclusions:
• More ionising initiating carrier – electrons results in a faster speed response.
• Increasing $d$ of initiating carrier reduces speed; Increasing $d$ of non-initiating carrier increases speed.
• Increasing $k$ will increase (decrease) $f_0$ for electron (hole) injection at same $d$
• Effect of $d$ on $f_0$ is greater than that of $k$