

Bounds on least pseudo-Anosov dilatations

Chia-yen Tsai

University of Illinois at Urbana-Champaign

June 14-20, 2008

$S_{g,n}$ = genus g surface with n marked points.

$f : S_{g,n} \rightarrow S_{g,n}$ homeomorphism. $\lambda(f)$ = the dilatation of f .

$S_{g,n}$ = genus g surface with n marked points.

$f : S_{g,n} \rightarrow S_{g,n}$ homeomorphism. $\lambda(f)$ = the dilatation of f .

Definition

$l_{g,n} = \min\{\log \lambda(f) \mid f : S_{g,n} \rightarrow S_{g,n} \text{ pseudo-Anosov}\}.$

$S_{g,n}$ = genus g surface with n marked points.

$f : S_{g,n} \rightarrow S_{g,n}$ homeomorphism. $\lambda(f)$ = the dilatation of f .

Definition

$l_{g,n} = \min\{\log \lambda(f) \mid f : S_{g,n} \rightarrow S_{g,n} \text{ pseudo-Anosov}\}$.

- ▶ Penner('91): $\frac{\log 2}{12g-12} \leq l_{g,0} \leq \frac{\log 2}{g}$.

$S_{g,n}$ = genus g surface with n marked points.

$f : S_{g,n} \rightarrow S_{g,n}$ homeomorphism. $\lambda(f)$ = the dilatation of f .

Definition

$l_{g,n} = \min\{\log \lambda(f) \mid f : S_{g,n} \rightarrow S_{g,n} \text{ pseudo-Anosov}\}$.

- ▶ Penner('91): $\frac{\log 2}{12g-12} \leq l_{g,0} \leq \frac{\log 2}{g}$.
- ▶ Penner('91): $l_{g,n} \geq \frac{\log 2}{12g+4n-12}$, for $3g + n - 3 > 0$.

$S_{g,n}$ = genus g surface with n marked points.

$f : S_{g,n} \rightarrow S_{g,n}$ homeomorphism. $\lambda(f)$ = the dilatation of f .

Definition

$l_{g,n} = \min\{\log \lambda(f) \mid f : S_{g,n} \rightarrow S_{g,n} \text{ pseudo-Anosov}\}$.

- ▶ Penner('91): $\frac{\log 2}{12g-12} \leq l_{g,0} \leq \frac{\log 2}{g}$.
- ▶ Penner('91): $l_{g,n} \geq \frac{\log 2}{12g+4n-12}$, for $3g + n - 3 > 0$.
- ▶ Hironaka-Kin('06): $l_{0,n} < \frac{2 \log(7+\sqrt{45})}{n-1}$.

$S_{g,n}$ = genus g surface with n marked points.

$f : S_{g,n} \rightarrow S_{g,n}$ homeomorphism. $\lambda(f)$ = the dilatation of f .

Definition

$l_{g,n} = \min\{\log \lambda(f) \mid f : S_{g,n} \rightarrow S_{g,n} \text{ pseudo-Anosov}\}$.

- ▶ Penner('91): $\frac{\log 2}{12g-12} \leq l_{g,0} \leq \frac{\log 2}{g}$.
- ▶ Penner('91): $l_{g,n} \geq \frac{\log 2}{12g+4n-12}$, for $3g + n - 3 > 0$.
- ▶ Hironaka-Kin('06): $l_{0,n} < \frac{2 \log(7+\sqrt{45})}{n-1}$.

Penner's lower bound $\Rightarrow \frac{\log 2}{4n-12} \leq l_{0,n} < \frac{2 \log(7+\sqrt{45})}{n-1}$, for $n \geq 4$.

$S_{g,n}$ = genus g surface with n marked points.

$f : S_{g,n} \rightarrow S_{g,n}$ homeomorphism. $\lambda(f)$ = the dilatation of f .

Definition

$l_{g,n} = \min\{\log \lambda(f) \mid f : S_{g,n} \rightarrow S_{g,n} \text{ pseudo-Anosov}\}$.

▶ Penner('91): $\frac{\log 2}{12g-12} \leq l_{g,0} \leq \frac{\log 2}{g}$.

▶ Penner('91): $l_{g,n} \geq \frac{\log 2}{12g+4n-12}$, for $3g + n - 3 > 0$.

▶ Hironaka-Kin('06): $l_{0,n} < \frac{2 \log(7+\sqrt{45})}{n-1}$.

Penner's lower bound $\Rightarrow \frac{\log 2}{4n-12} \leq l_{0,n} < \frac{2 \log(7+\sqrt{45})}{n-1}$, for $n \geq 4$.

Guess

$l_{g,n}$ tends to zero with the order of $\frac{1}{g+n}$.

Guess

$l_{g,n}$ tends to zero with the order of $\frac{1}{g+n}$.

Theorem (T,2008)

Given genus $g \geq 2$, $\exists c_g$, a constant depending on g , such that

$$\frac{\log n}{c_g n} < l_{g,n} < \frac{c_g \log n}{n}, \forall n \geq 3.$$

Guess

$l_{g,n}$ tends to zero with the order of $\frac{1}{g+n}$.

Theorem (T,2008)

Given genus $g \geq 2$, $\exists c_g$, a constant depending on g , such that

$$\frac{\log n}{c_g n} < l_{g,n} < \frac{c_g \log n}{n}, \quad \forall n \geq 3.$$

Question What is the optimal constant c_g ?

Guess

$l_{g,n}$ tends to zero with the order of $\frac{1}{g+n}$.

Theorem (T,2008)

Given genus $g \geq 2$, $\exists c_g$, a constant depending on g , such that

$$\frac{\log n}{c_g n} < l_{g,n} < \frac{c_g \log n}{n}, \quad \forall n \geq 3.$$

Question What is the optimal constant c_g ?

Question What is the right asymptotic behavior of $l_{g,n}$ for any g and n ?